The Electrical Industry's Weekly Magazine

December 4, 1961

Electrical World

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National Emergency Alarm Repeater

Technical Details on Warning System Offered by OCD . . . page 68

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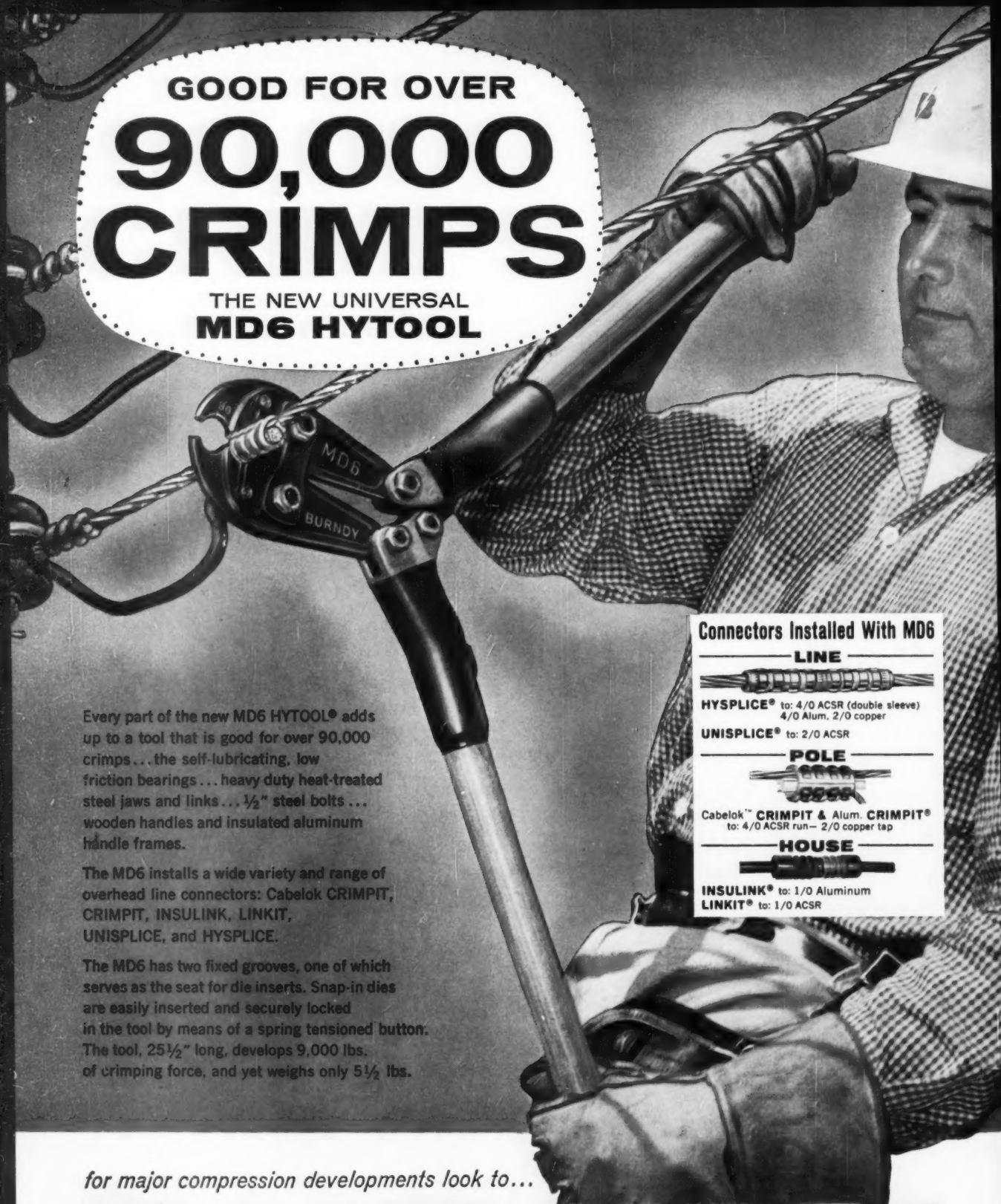

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Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

DECEMBER 4, 1961
Vol. 156, No. 23

Dateline . . .

New Frontier Power Policy—In Perspective III

Washington, D. C.—The bitter contest over Hanford generating facilities in the House of Representatives clearly split the 1961 Congressional session into two segments as far as power legislation was concerned.

The first segment was climaxed by the defeat of the Hanford power facilities. The second was climaxed by the initial approval of the Colorado lines.

The surprising House opposition (251-155) to the big, key federal power project produced animosity from Congressional public power supporters, which bodes ill for investor-owned power in the coming session. And the vote also galvanized White House support (perhaps fleeting) for its own power program on Capitol Hill.

Not only did the Hanford battle charge the air of Capitol Hill with public, investor-owned sentiment, but prior to its consideration, Hanford had helped hold back power activities on Capitol Hill. Among these were the public works appropriation bill, the Colorado project lines authorization and a Senate study on fuels and energy.

Congress' record on power issues before the Hanford fight was one of stumbling and indecision, more or less waiting on a clarion call from the White House as to what its program would be. In the meantime, routine power legislation—some of it controversial, such as Burns Creek—was re-introduced, reconsidered, re-assigned to uncertain cubbyholes.

President Kennedy had sounded the trumpet for a general power program in February, but a specific program wasn't forthcoming. Nor did the White House offer much direct support for any power issues. To his credit, President Kennedy didn't rush in with a program before he had time to study it.

Many public power leaders had taken a paternalistic attitude toward all segments of the power industry, willing to bide their time, confident that they were "riding the wave" of sentiment, certain they were in control.

But Hanford changed this attitude. It put "public vs private power" back in the headlines. It brought

(*Continued on page 5*)

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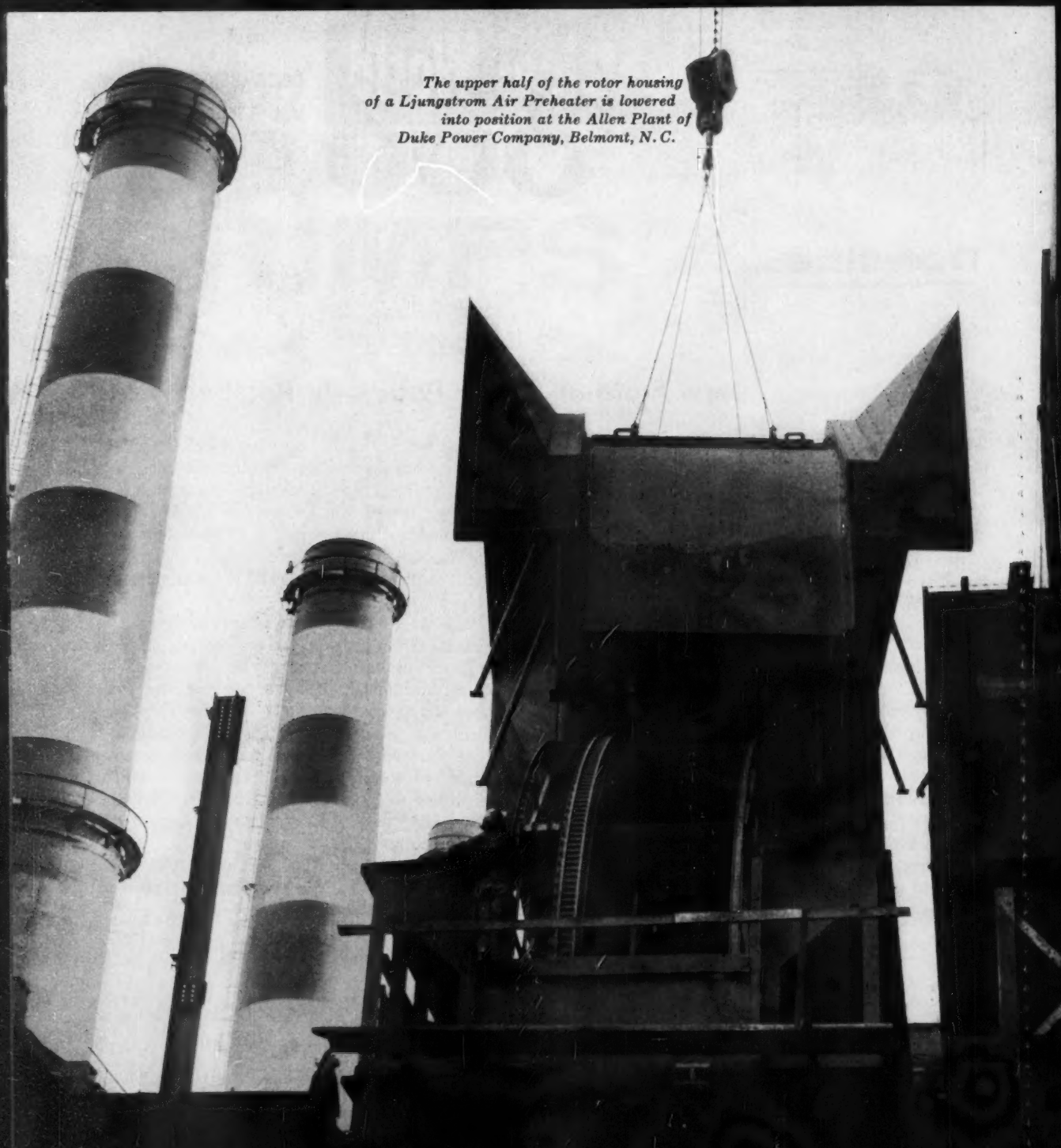

The upper half of the rotor housing of a Ljungstrom Air Preheater is lowered into position at the Allen Plant of Duke Power Company, Belmont, N. C.

IN NORTH CAROLINA . . .

DUKE POWER INSTALLS ITS 47th LJUNGSTROM®

Duke Power engineers expect 10% annual fuel cost savings with Ljungstrom Air Preheaters at Belmont. Two 512,000-lb Ljungstroms on the #5 boiler of the Allen Plant will preheat incoming air from 80°F to 575°F. Continuous rotary regeneration will recover approximately 390°F waste heat. Every 40° thus recovered cuts fuel requirements 1%.

Our engineers will be glad to recommend how Air Preheater equipment can improve your operating results on new or existing fuel fired units.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N.Y.

Dateline...

Washington, D. C. (*Continued from page* 3)
power discussions down to a lower level, resulting in some of the rash demands for investigations of all phases of investor-owned power. It also spurred a united Democratic front—White House and Congress—at least long enough to assure success for a federal grid for the Upper Colorado project.

Hanford opposition came from three or four sources: **(1)** An angered coal industry, also upset by the Administration's attitude on oil imports, **(2)** Investor-owned power, fearful of a new federal precedent on steam generation; **(3)** A "safety valve" phenomenon in Congress, by which a latent coalition kicked up its heels in opposition to an issue just to show it wasn't dead. In this case, Southern, conservative Democrats joined with a near-solid GOP front.

The long range effects of the Hanford vote are: **(1)** Hanford is probably dead for the time being, at least as a federal project. In the meantime, other groups, such as the State of Washington or a public power district, may consider building it. **(2)** Public power resentment may well up in coming sessions to produce more bitter attacks against investor-owned power. **(3)** A more united front may possibly be presented by the Kennedy Administration on power issues.

The immediate effect of the Hanford vote produced an all-out White House effort to hold the line on federal transmission funds. Even though this succeeded, the margin of victory wasn't large.

Most other issues were too far gone, or too complicated to be salvaged by a united front at that late date in the session.

Nevertheless, an effort was made to add preference to the Delaware Compact, which was too little, too late. Bickering over the Water Council and Natural Resources Council issues forced these measures into 1962.

Letters

Let's Specify Fixed Charges

To the Editor:

The 12th Steam Station Cost Survey in the Oct. 2 *Electrical World* appears to be a very important and useful study of potential value perhaps to the whole electrical industry. It was extremely interesting to me and I am sure many others have found the results most helpful in the various comparative evaluations and analyses we in the electric industry are constantly making.

When I read the discussion of the wide range of 20:1 in fixed charges, from 0.4 mills to 8.25 mills, and the range of 2.84 to 20% in the percentage applied to investment in computing fixed charges, it occurred to me that perhaps this section of the survey might be improved in the future. I was unable to find the term "fixed charges" defined in either this presentation or the questionnaire which this company completed as one of the 57 reporting companies. Consequently, it is conceivable that you may have received data prepared on the basis of 57 different interpretations of the term.

Therefore, may I suggest that in your 13th Steam Station Cost Survey you list the components you wish included in the percentage used for "fixed charges" in some such manner as this:

1. Rate of return or cost of capital..... %
2. Corporate depreciation .....
3. Local property taxes .....
4. Operation expense .....
5. Maintenance expense .....
6. Administrative and general expense.....
7. Federal income taxes.....

Total Fixed Charges %

Items 1, 2, and 3 are the items that I would consider as "fixed charges" in the strict sense, yet I am confident you will find most or all of the other components in percentage totals that exceed 10%. If you can get the reporting on the same comparable basis, the fixed charges will fall within a more narrow range, will avoid distortion in the total cost of energy for the various units, and I believe this section of your survey will be more meaningful.

E. L. Grove
Executive Assistant, Connecticut Light & Power Co
Berlin, Conn.

▶ Our response to this thoughtful letter will be found in Editorial Comment (p 63).

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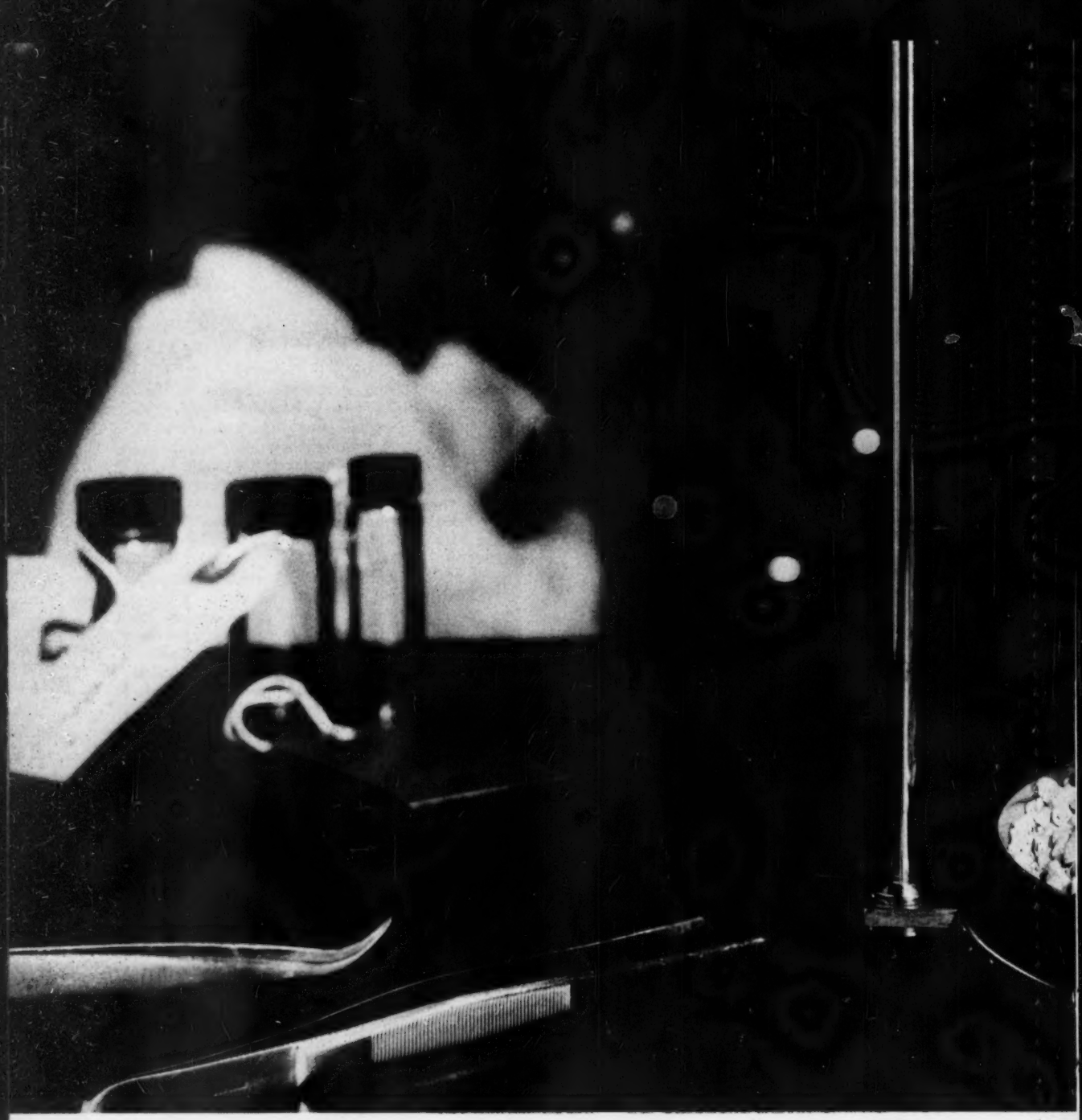
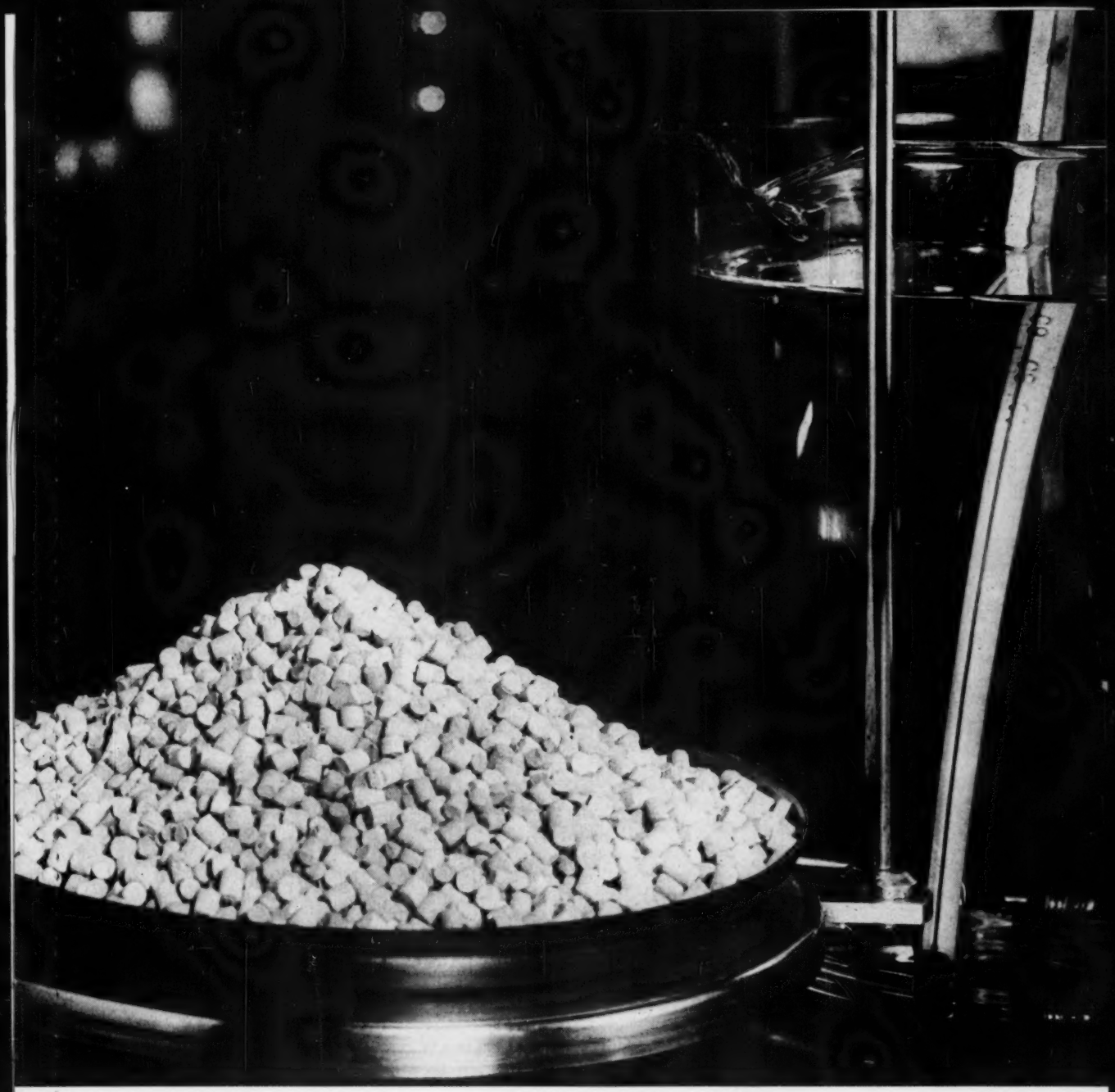


How a new Gulf process makes a lasting

You're looking at a new catalyst (the tiny pellets). It's the heart of Gulf's new hydrogen treating process, called Gulfinishing, used to super-finish Gulfcrest® Oil. Over the years, Gulfcrest Oil has piled up amazing performance records as a turbine lubricant. Many electric utilities have reported Gulfcrest in service for 20-25 years. An enviable record in an industry that demands ultimate dependability. But, Gulfcrest has been improved and is now better than ever. How?

Gulfinishing replaces the conventional acid and clay treatment for producing base stocks. It removes more undesirable compounds than any other process. It converts unstable molecules into stable ones. And, it remarkably improves the additive response of the base oil.

The results: the oxidation life of new Gulfcrest is even longer; color stability and corrosion resistance even better. In short, the all around performance of



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"A 5% saving in operating cost plus higher resale value is why we're buying Ford Trucks exclusively"

says James Lafferty, Transportation Manager for Henkels & McCoy, Inc., Philadelphia, Pennsylvania

"We ran a six-month comparative test on six Ford Trucks against six equivalent competitive models and found that the Ford Truck operating costs consistently ran 5% less than the others. Also, the increasing popularity of Fords with truck users means that we invariably pick up an extra $100 to $200 at resale time.

"Our company has 441 Ford Trucks operating from one end of the country to the other. Less than 20% of our fleet is within practical traveling distance of our two maintenance depots, so we depend on local Ford Dealers for the bulk of our service work. The complete network of Ford Dealers—even in remotest areas—provides unparalleled service everywhere.

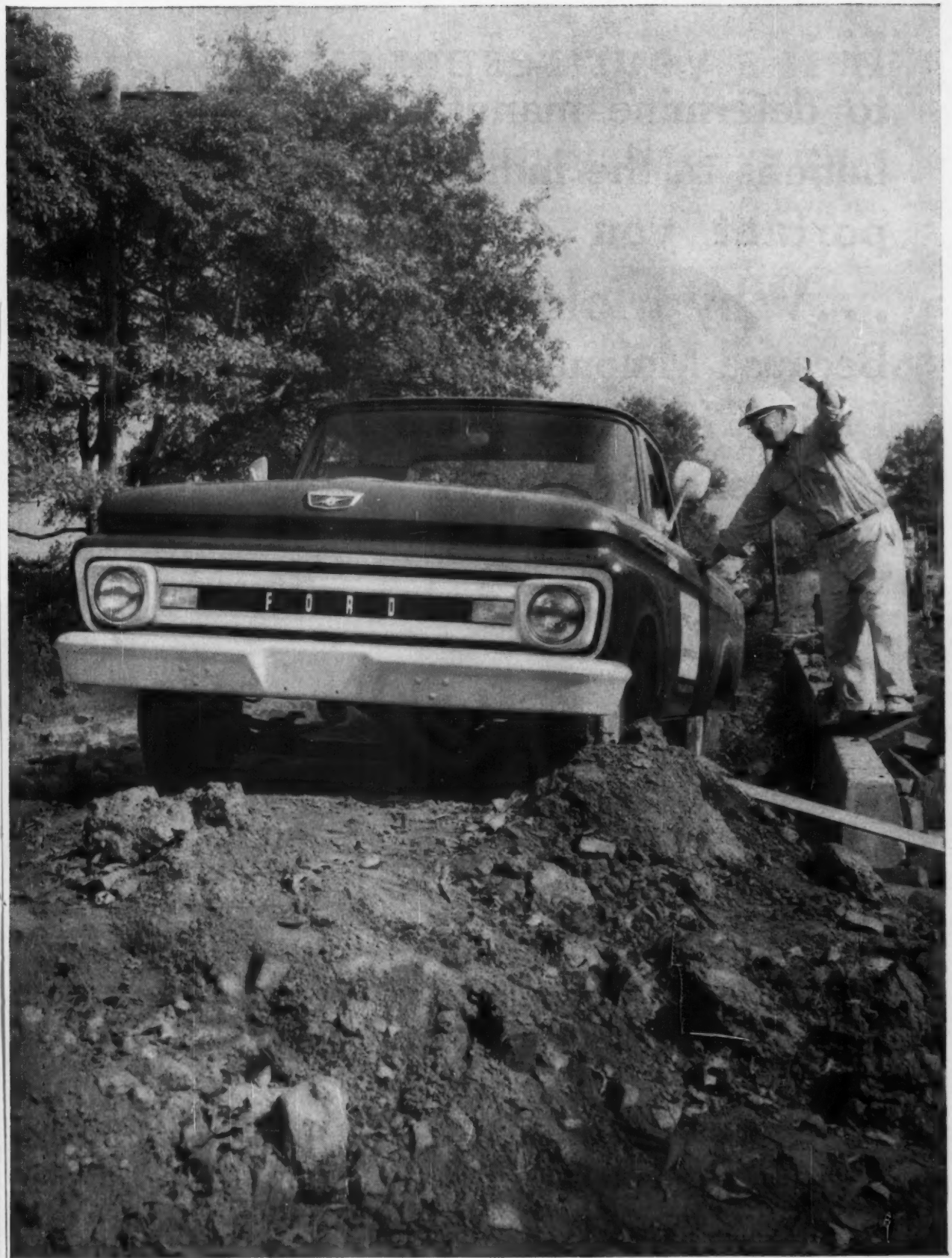
"We specialize in handling construction and maintenance jobs. For example, we maintain utility lines, telephone lines, gas pipelines, and put in city and shopping center lighting systems. On these jobs, our trucks usually have to make their own way, road or no road. We use Ford F-250 4-wheel drive pickups in transporting crews to construction sites and F-600's to handle telephone line or pipeline construction, while our T-750 Tandem Axle trucks are equipped with a boring unit to dig 11-foot-deep holes for powerline transmission poles.

"Ford's rugged dependability, universal adaptability and superior economy keep us buying Ford Trucks exclusively."

Solid testimony that Ford's full-time economy only starts with low price!

FORD TRUCKS COST LESS

PRODUCTS OF Ford MOTOR COMPANY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If it's your responsibility...

to determine manufacturers' contributions to the industry, then it's important you consider Moloney!

...Why Moloney?

Because Moloney's concept of "Total Design" has consistently led to greater total benefit for users.

Moloney is more than just a company name. It's a tradition. Over the years Moloney has come to be known for its development of new methods, new techniques and materials which give better performance and greater efficiency to the user . . . all within the concept of "Total Design".

For example, the Moloney Core is one of the industry's four basic core designs . . . and Duratherm Insulation Paper is one of only three high temperature papers presently available. These are but two of the Moloney developments that contribute to better all-around transformer performance.

Ask your Moloney representative about the many other developments which contribute to Moloney's "Total Design" concept and which have made Moloney one of the leading transformer manufacturers.

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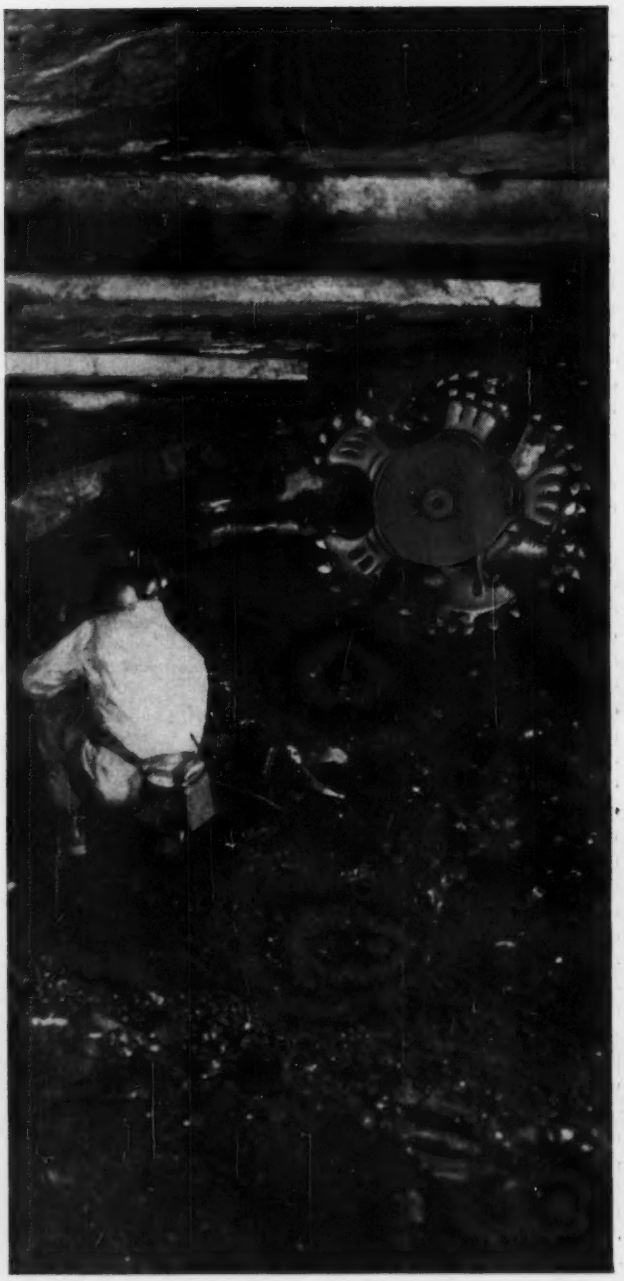
MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers and Switchgear for Utilities, Industry, and Electronic Applications

EASTERN OFFERS MORE THAN COAL



Coal buyers who look for the most for their fuel dollar know that a given coal has certain specific characteristics. They also know that the full value of the coal depends on the organization that produces it. Such extras as on-time delivery, consistent adherence to contract specifications, ready assistance in solving a complex fuel problem . . . all these and many others are of even more importance. That's why Eastern Gas and Fuel Associates stress the "extras" that are a part of every ton of coal they sell.

Call your Eastern representative for full information on how Eastern Gas and Fuel Associates can help you to make your fuel program more efficient, effective and economical.

RESERVES—Eastern Gas and Fuel Associates' properties include coals from the Pocahontas, Pittsburgh, Eagle, Hernshaw and many other well-known and desirable seams. Their total reserves will satisfy present production rates for more than one hundred years, and Eastern is constantly on the alert to acquire additional desirable acreage.

EASTERN GAS AND FUEL ASSOCIATES

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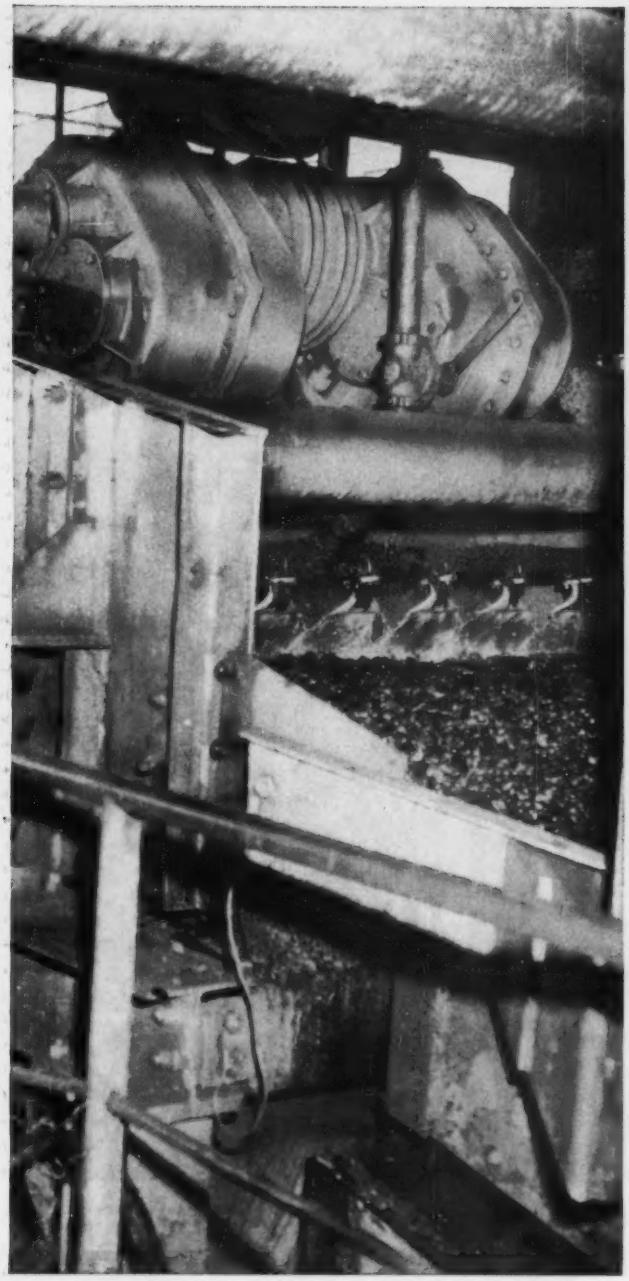
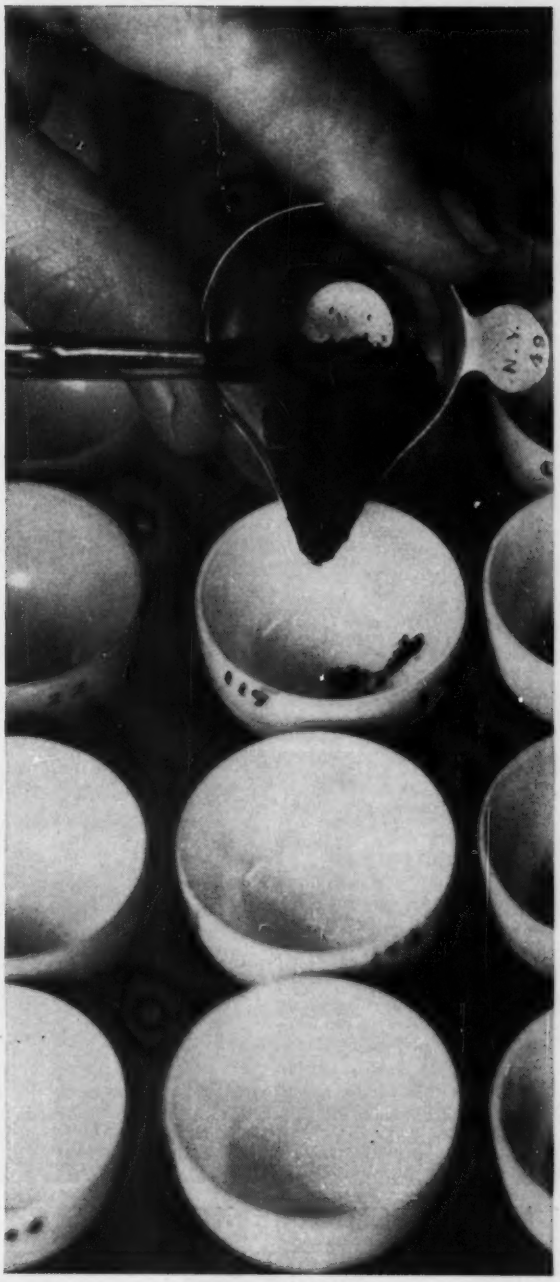
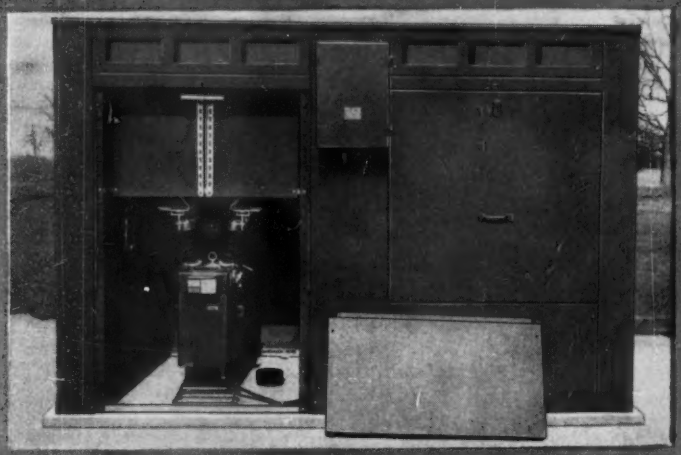


QUALITY—By the application of the most modern mining and coal preparation techniques, Eastern is in a position to meet requirements for specific types, sizes and grades of coal for both steam and metallurgical use. Eastern's modern preparation plants produce coals that are cleaned, sized and graded—coals *engineered* to suit your specific needs.



SERVICE/RESEARCH—Eastern's service is backed by a customer-oriented research program. While Eastern did not invent coal research, they established the *first* coal company research laboratory, and have made research an integral part of all their operations. Eastern's service includes basic research, close cooperation with customer engineering staffs, an integrated program of information exchange with equipment manufacturers and a tremendous backlog of technical information on present and potential uses of coal.

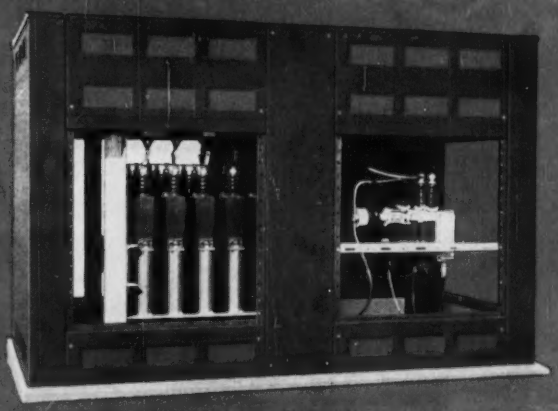
EASTERN GAS AND FUEL ASSOCIATES



L-M TRANSCLOSURE HOUSING containing load transfer equipment. Switching is performed by two L-M 14.4 kv 400 ampere oil switches. Sensing voltage obtained from two potential transformers mounted in the housing activates the L-M type S control, which in turn opens and closes alternate circuits to assure a continuous flow of power to the load. Each oil switch is equipped with a manual group-operated disconnect switch to permit rapid and safe maintenance. When the manual disconnect switch is in the raised position, the oil switch can be rolled out of the housing for inspection or maintenance.

OVERHEAD RESIDENTIAL DISTRIBUTION was resulting in distortion of radio waves from a U. S. Air Navigation VORTAC facility 2000 feet away (left). It became necessary to install distribution underground. To avoid the high cost of underground vaults and submersible equipment, the utility used L-M Transclosure housings with conventional pole type distribution equipment (right). Results: L-M Transclosures provided an economical solution with better accessibility.

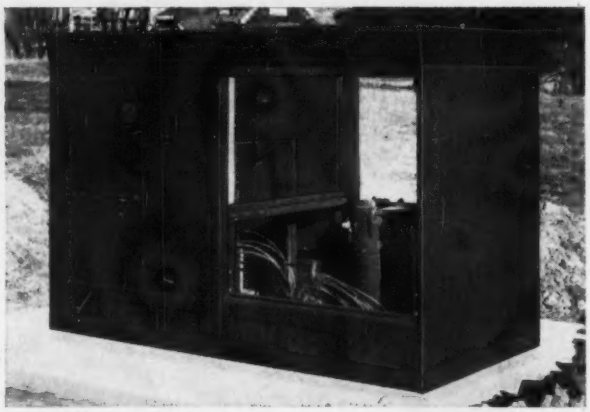
SEVEN L-M TRANSCLOSURE housings are ganged to provide safe protection for street lighting regulating and control equipment at West Allis, Wisconsin. Five regulators plus all controls for five lighting circuits are now housed in this attractive installation. A substantial saving over brick construction was realized.



THESE TRANSCLOSURES HOUSE a pre-fabricated 600 kvar, 3-phase capacitor block. Installation includes controls, switches and bus. Savings of thousands of dollars can be made over conventional housed capacitors.

L-M TRANSCLOSURE HOUSINGS PROVIDE ECONOMICAL 3-HOUR INSTALLATION

HIGHWAY LIGHTING, U. S. 141, WISCONSIN: To house transformer, protective and switching equipment for a 4-way highway intersection, L-M Transclosures were selected. Here they are, as they arrived, in crates. At 12:40 p.m. crew went to work.



3:50 P.M., THREE HOURS LATER. Transclosure frames were bolted to the pad, side panels attached, equipment installed, ready for wiring—all by a crew that had never before seen this equipment. Time was cut substantially as the crew gained experience.

528

CONTROLS FOR LIGHTING the athletic fields and parking lots at a midwest high school are contained in this Transclosure housing. The double unit shown contains seven L-M type NR oil switches, and high voltage primary terminations and fusing.

L-M's Transclosure™ Housings Economical For All Types Of Distribution Equipment

Modular construction and range of sizes ideal for all types of equipment including transformers, regulators, reclosers, switches, protective equipment, controls, meters, capacitors, load transfer equipment, arresters, buses and insulators.

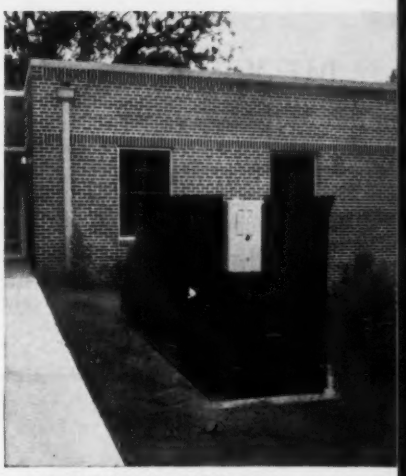
L-M Transclosures are fabricated steel housings featuring modular design. They can be installed singly or ganged, in a variety of sizes, to house almost any imaginable type of distribution equipment. Additional units may be added at any time.

You have complete flexibility of installation. Transclosures can be installed outdoors at ground level on concrete pads for underground distribution. They are equally versatile on roof tops or indoors. You can install them anywhere. They eliminate the need of expensive vaults or masonry cubicles.

Adequate ventilation is provided for all equipment. Vents at top and bottom have baffles preventing the entrance of all foreign objects, including wildlife. Removable panels can be locked in place to prevent the entrance of all unauthorized personnel.

Get Specifications, Details

Contact your L-M Field Engineer. He's anxious to discuss your enclosure problem with you. Ask him for Bulletins on L-M Transclosure housings. Or write Line Material Industries, Milwaukee 1, Wisconsin



L-M TRANSCLOSURE HOUSINGS at Bartlett Memorial Hospital, Sapulpa, Oklahoma. Three Transclosures are ganged to enclose two 50 kva, one 75 kva distribution transformers, and current transformers. Metering cabinet is shown at end of unit. Complete erection, including assembly and bolting, required only 8 man-hours of labor.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

Transclosures

McGRAW EDISON

529

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
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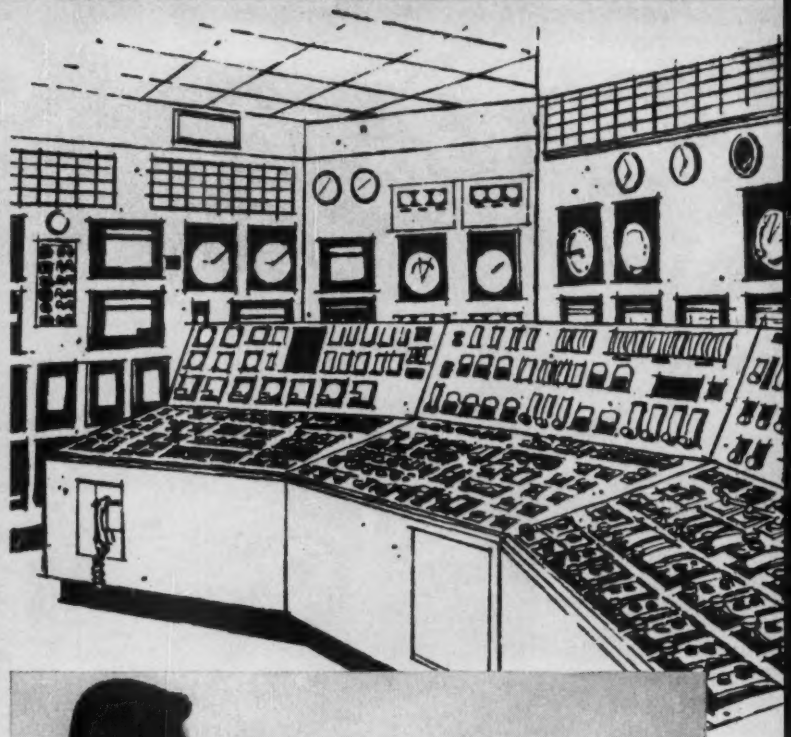


FIRST SIMPLIFY...

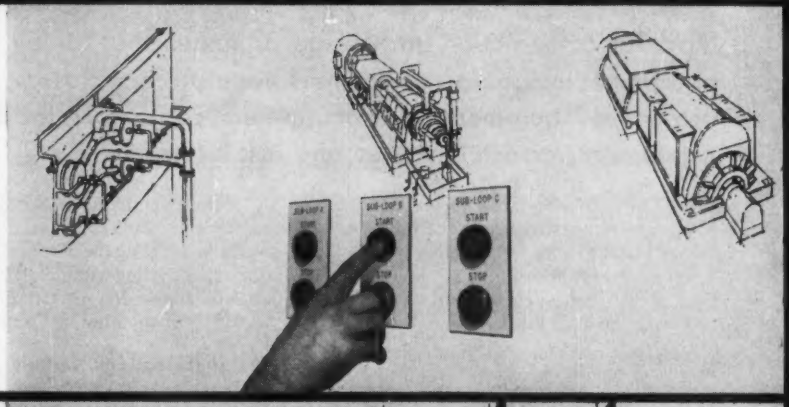
First step to automation is to *simplify* the information now presented by a multitude of multi-record charts, gages, and annunciator lights. The Bailey approach gives the operator data he needs (logged periodically), keeps continuous watch on all variables, makes calculations where required, alarms when trouble threatens.

Bailey 700 Systems draw on the best available techniques, including analog and digital manipulation, trend recording, time sharing, scanning, alarming, calculating, controlling, and logging, as required to meet operating objectives.

Reliability of recorded data is increased ... operators can devote full attention to correcting off-normal conditions and improving operations. The system may include frequent performance calculations showing the contributions of each portion of the cycle to over-all performance so that faults and deterioration may be spotted and corrected.

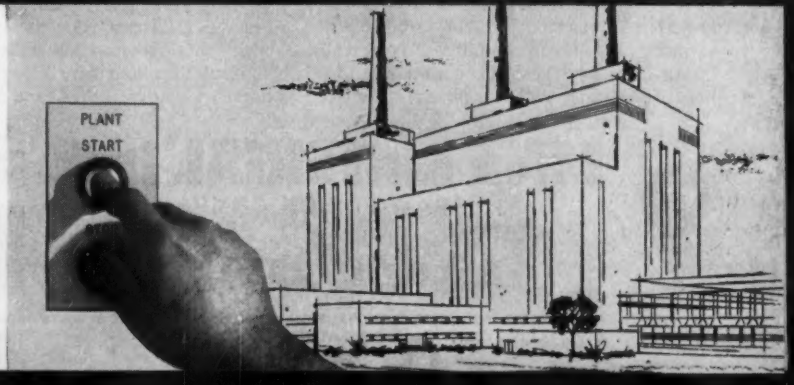
NEXT VERIFY...

Next verify the practicability of automation by extending supervisory controls, letting equipment perform more operating functions. Automate key systems, one at a time, by push-button-controlled subloops. This approach smooths the transition to complete automation.



THEN AUTOMATE

Final steps are: (1) consolidate supervisory controls, conventional controls, and subloops for full-range automatic operation once the plant has been placed on the line; and (2) add start-stop control to provide full automation.



first Simplify...

NEXT VERIFY...
THEN AUTOMATE

Bailey verified steps to automation mean benefits now... and increasing benefits as you go

Automation need not be an all-out commitment. Between today's conventional power-station control and the ultimate in automation are step-by-step advantages that can be gained—as individual problems are resolved.

This permits the final investment commitment only after satisfactory evidence that it is economically justified and practicable.

Bailey Systems concepts are embodied in the approach, "First simplify — next verify — then automate". The steps outlined here coordinate the best available techniques, including analog and digital, in Bailey 700 Systems designed — and expanded as desired — to the needs of the individual plant. They may be undertaken singly, in combination, or in entirety. System elements are composed of solid-state electronic modules providing the ultimate in reliability and flexibility.

Bailey 700 Systems are in operation today —or on order for installation—from coast to coast and all over the world. Ask your Bailey Engineer, or write for details. Bailey Meter Company, 1060 Ivanhoe Road, Cleveland 10, Ohio. In Canada — Bailey Meter Company Limited, Montreal.

System concepts founded on 45 years of experience

21 out of 26 of today's "most efficient" steam-electric stations in the United States use Bailey Instruments and Controls*. This reflects the more than 45 years of Bailey developments devoted to improving the reliability of power-plant operation. These developments include experience in automation, dating from electrically operated boiler controls in 1924 and automatic start of boiler controls on steam-electric locomotives in 1936, to systems installations in operation, or under construction today, from coast to coast and throughout the world.

**Listed in Federal Power Commission Report S-143.*

A 166-2

BAILEY METER COMPANY

700 Systems

Aluminum Landmark.

This sleek-looking transmission tower was developed, with assistance from Olin Aluminum, by Alrectic Division of McGraw-Edison Company and a leading utility in the Mid-South. This unique tower is fabricated by Alrectic of specially extruded members welded together. The design required selected alloys and new fabricating techniques; these were part of Olin's special contributions. It was designed for neighborhood use in tapered octagonal construction. And there's a bonus: this tower weighs 70% less than a steel tower and 90% less than one of concrete. Its strength is 12% greater than required standards. And, of course, being aluminum, it never needs painting. That's two big savings: reduced handling and labor costs and lack of maintenance. It's a great working example of how a manufacturer (and a community) can benefit from working with Olin Aluminum's research staff. More and more, manufacturers who want to incorporate new designs with extra savings, think in terms of aluminum. And more and more Olin Aluminum's research and marketing thinking have proved to be the most profitable answer to many a manufacturer's problem. Don't you think it would be a good idea to call your Olin Aluminum Sales Office or your local Distributor for creative, marketing, and production help?

McGraw-Edison products are marketed by Line Material Industries

Olin
ALUMINUM
400 PARK AVE., NEW YORK 22, NEW YORK

Electrical World

DECEMBER 4, 1961
Vol. 156, No. 23

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The Electrical Week

LATE NEWS ▸

Interconnection at 345-kv between American Electric Power System and Illinois Power Co is announced jointly by Philip Sporn, AEP, and Allen Van Wyck, IPC. It will be the first direct tie between the systems, though they are connected indirectly. Most of the 32-mile line will be built by IPC and the remainder by Indiana & Michigan Electric Co, an AEP operating company. The line is scheduled to go into operation in June, 1963, under a 50-year agreement.

Kennedy Administration cost-cutting and unfavorable economics of small nuclear reactors cause Atomic Energy Commission to "defer indefinitely" the Small Pressurized Water and the Low Temperature Process Heat Reactors. Construction of both projects has been delayed three years for various reasons.

Merger of Colorado Central Power Co into Public Service Co of Colorado will take place December 29. Stockholders of both approved the merger by overwhelming majorities. Merger will add about 40,000 customers and 800 sq miles of service territory to PSCo.

Saxton Nuclear Experimental Program gets provisional operating license from Atomic Energy Commission. The 5-Mw experimental reactor at Saxton, Pa., is owned and operated by four operating electric companies of General Public Utilities Corp. Westinghouse designed and built it.

National consumer magazines will carry a total of 82 pages of Live Better Electrically advertising in 1962, according to William M. Shepherd, vice president, Arkansas Power & Light Co, and chairman of the LBE policy committee. Added to list of publications this year is *American Home*. An eight-page, full color insert in February *Reader's Digest* is a highlight.

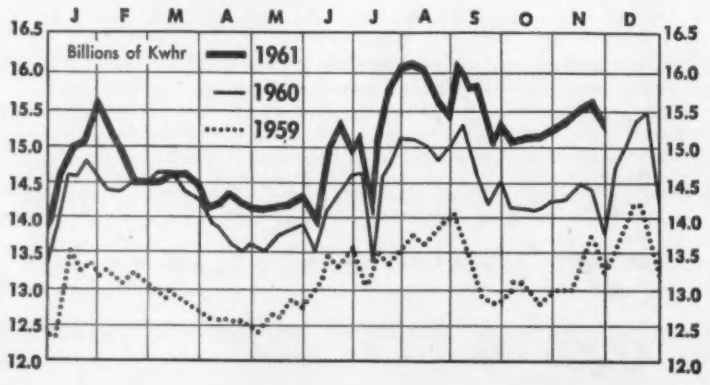
Interior Department Officials will meet December 8 in Minneapolis with representatives of 14 Missouri Basin power companies and the Mid-West Electric Consumers Assn to discuss the 14-company offer to firm up 650 Mw of Bureau of Reclamation power for preference customers in the area.

New chairman of NEMA's Generation, Transmission, and Distribution Equipment Division is Louis J. Ott, sales vice-president of Ohio Brass. J. F. Chipman, general manager of Allis-Chalmers's Boston Works power equipment division is elected vice-chairman.

GE cuts price on distribution transformers rated 37½ and 75 kva by 3%. New price is effective on November 27th.

WEEKLY POWER OUTPUT—Up 10.4%

(Week ending Nov. 25), Kwhr 15,330,000,000



Percent Change From Previous Year

	Nov. 11	Nov. 18	Nov. 25
Total U. S.....	+ 7.0	+ 8.6	+10.4
New Eng.	+10.5	+10.6	+12.0
Mid. Atlan. ..	+ 7.9	+10.2	+11.5
Cent. Indust. ..	+ 5.3	+ 8.5	+10.0
West Cent. ...	+ 6.9	+ 9.4	+11.9
Southeast	+ 3.4	+ 4.2	+ 9.1
South Cent. ..	+ 8.2	+ 8.4	+ 8.9
Rocky Mount...	+13.2	+13.6	+11.5
Pacific			
NW	+ 8.8	+ 7.7	+ 8.2
SW	+13.6	+15.2	+14.4

Seasonally Adjusted Index 302

Week Ago 301 Year Ago 272

Source: Edison Electric Institute

Supply Lines

GAO 'BUY-AMERICAN' RULING GOES AGAINST ALLIS-CHALMERS

The General Accounting Office has ruled in favor of Baldwin-Lima-Hamilton Corp and against Allis-Chalmers Manufacturing Co in the Buy-American controversy over which company should build some 15 212,000-hp hydraulic turbines for Lower Monumental and John Day dams. The decision has been sent to the US Army Corps of Engineers, which will probably award the contract to Baldwin, although it is not legally bound to do so. There was no immediate comment on the ruling from either Allis or Baldwin.

Several issues were raised by Allis in its protest to GAO which has replied on all but one. First, Allis charged that Baldwin had erred when it stated that some 42.7% of the costs of the turbines would be incurred in Japan. Allis said that, according to its own computations, Baldwin's foreign share was actually 56.2%, or over the 50% maximum allowed for a domestic bid.

In its ruling, GAO said that actually both Baldwin and Allis had made mistakes in their computations, both on the high side. According to an Army study of the facts, GAO said, the foreign share of Baldwin's bid was about 38%, not 42.7%. But because Baldwin's error acted against its interests, GAO said it did not "believe the error has prejudiced any other bidders."

On the other hand, when Allis's errors were corrected on its computations, GAO found that on the basis of Allis's own cost figures, "The cost of (Baldwin's) foreign components . . . would be 42.8% of the cost of all components, or only 0.1% more than the figure of 42.7% estimated by Baldwin in its bid."

On the second issue raised, GAO said to Allis, "Your contention that Baldwin's bid should be rejected on the ground that it cannot qualify as a domestic bid under the provisions of the Buy-American Act overlooks or ignores the fact that, while the Act gives preference to domestic bids, it does not prohibit, without any exception, the consideration of foreign bids. To the contrary, the Act expressly provides that the restrictions contained therein against the purchase of foreign products do not apply where the cost of domestic products is unreasonable." Even if Baldwin's bid were classified as a foreign bid, GAO said, it would still be low because Allis's bid was 14% higher than Baldwin's bid, or 2% higher than the maximum 12% differential allowed under the executive order administering the Buy-American Act.

On the third question—whether the executive order administering the Act was against the intent of the Act itself, GAO said, "It is our opinion that, since the Buy-American Act is silent as to the basis upon which it is to be determined whether or not an item is manufactured 'substantially all' in the United States, the (50%) criterion stipulated in the executive order for determining whether a bid is domestic or foreign is properly within the executive discretion."

On a related matter, that of reducing the 50% foreign share now allowed for a domestic bidder, or of computing shares on the basis of man-hours of employment rather than costs, GAO said, "These are not matters within the jurisdiction of this office, but rather, since they involve either an amendment to the Act or to the executive order, are for consideration by the Congress or the President."

On the question of national security, which Allis said would be impaired if the award went to Baldwin because of the extent of foreign procurement involved in Baldwin's bid, the GAO asked the Army for an opinion and said it received this:

"In regard to the request of Allis-Chalmers . . . that this case be referred to the Director of the Office of Civil and Defense Mobilization, it is not considered that award of this contract to Baldwin-Lima-Hamilton Corp would impose a threat to impair the national security . . . The Director of OCDM has been kept informed regarding award of all contracts for hydraulic turbines since his (1959 decision saying they were not a threat), and he has made no change in his decision." GAO also told Allis that it had been "informally advised that the Director (of OCDM) has denied your request . . . for the review of the present proposed award."

But on one issue raised by Allis, GAO is in agreement. Allis had said in its protest, "we strongly believe that the present requirements for bidding work of this type should be revised and that any manufacturer contemplating using foreign materials be required to submit with his bid a complete list of all parts to be supplied from foreign sources. We also believe that procuring agencies should set up policing procedures to insure that contractors utilizing foreign suppliers do not furnish more material of foreign origin than originally listed with their bids."

In response, GAO said, "We are in complete accord with your suggestion." And GAO added that it was going to ask the Army to consider "the desirability of including provisions of that nature."

B. E. Smith, general manager of Allis-Chalmer's hydraulic division, who was appearing before a subcommittee of the House Labor Committee at the time of the decision, later commented that he felt the decision sidestepped the issue of whether the executive order was against the intent of the Act. He was testifying at a hearing on "the impact of imports and exports on American employment."

Smith also said: "This will put pressure on all hydraulic turbine manufacturers, and eventually on all heavy equipment manufacturers, to produce overseas."

GE RAISES PRICES ON MOBILE SUBSTATIONS AND TRANSFORMERS

A realignment of prices of mobile substations and mobile transformers, with increases over previous prices ranging from 4 to 8%, has been announced by General Electric's Power Transformer Dept. The new substation and transformer prices became effective Nov. 27.

MORE DAMAGE SUITS FILED BY ARIZONA PUBLIC SERVICE

Arizona Public Service Co has added six damage suits totaling $11.2 million against 18 manufacturers to its previously filed (EW, Nov. 20, p 16) $26-million suit. In the new suit (the first concerned turbine generators) the utility alleges overcharges in the purchase of condensers, power switching equipment, power transformers, power switchgear assemblies, meters, and circuit breakers.

THREE MORE FIRMS GET FUEL OIL IMPORT TICKETS

Interior Department has turned loose tickets to import 3,284,783 bbl of residual fuel oil between now and March 31. Quotas totaling 224,588 bbl went to three firms that have never had them before under oil import controls, and the rest was pro-rated among current importers.

10 to 25% off!

Let's say you are willing to sacrifice a little quality and buy a carload of distribution materials for ten per cent less than O-B prices. Do you realize it would still cost you the O-B price, *and probably considerably more?* You would lose money as well as O-B quality!

This carload would go into your warehouse, and part of it might stay there for some time. Every day, every piece would be soaking-up more and more "cost of possession." Few power company warehouses operate as low as ten per cent of the cost of inventory - - many as much as 25 per cent when accounting is realistic.

At the other end of your telephone is a local Graybar house. They have O-B distribution insulators, hardware, and lightning arresters in stock. If these stocks are not large enough, or are the wrong kind, this will be corrected. Agreed minimums will be maintained. You can get what you need, when you need it, *as you need it.* You let people in the warehousing business take care of your storage. You assume no obligation. You pay only published O-B prices and save the cost of possession. It's worth at least ten per cent - - maybe twice that!

And there's something "to boot" in the bargain. You get the recognized best distribution materials on the market - - O-B.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

10140-H

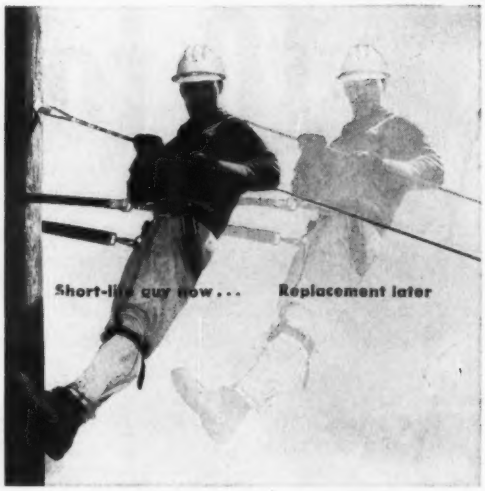
Distributed by GRAYBAR ELECTRIC COMPANY

Are you paying for

TWO GUYS

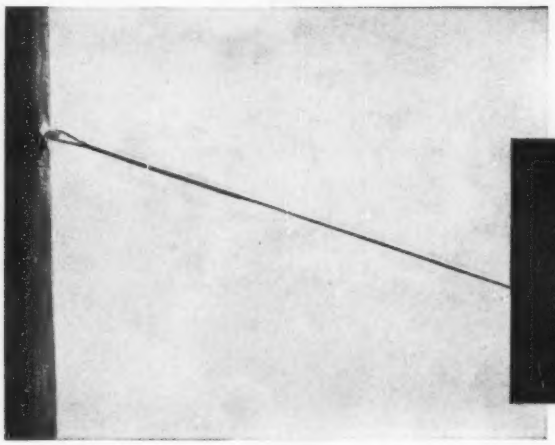
During the life of

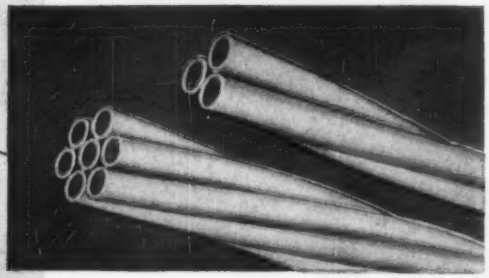
ONE POLE?



INSTALL **ALUMOWELD® STRAND** ONCE

and eliminate replacement costs





There's no built-in replacement cost to be paid later when you buy Alumoweld Guy Strand. Alumoweld matches the long life of modern poles, as a guy strand should. It stays up and retains its strength, unimpaired by years of exposure to the elements, because an *extra-thick* aluminum covering (25% by area) protects the steel core from rusting.

Size for size, Alumoweld Guy Strand has the same tensile strength as extra-high-strength steel . . . weighs less . . . is easier to install . . . and will last far longer.

Why pay for two guys during the life of one pole when one Alumoweld Guy will do the job and save you money and trouble? For your convenience, stocks of Alumoweld Strand are available for immediate shipment from our warehouses in New York, Chicago, Pittsburgh and Memphis.

COPPERWELD STEEL COMPANY WIRE AND CABLE DIVISION, GLASSPORT, PA.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Canadian Distributor: NORTHERN ELECTRIC COMPANY LIMITED

ALUMOWELD **GUY STRAND**

BULLETIN: EARLY TABULATIONS SHOW NEW *FLEET-SIZE* LARK HAS WON ACCEPTANCE

'62 LARK FLEET ORDERS IN FIRST 3½ WEEKS—

State of Connecticut • Railway Express Company • Avis Rent-A-Car, Miami • Winnetka, Ill. Police Dep't. • State of Florida • Yellow Cab Co., Erie, Pa. • F. W. Means & Company • University of California • Norwalk Tire Company Northern Illinois Gas Co. • Firestone Tire & Rubber Co. • City of Cleveland, Ohio • Frenat Cab Co., New York National Cash Register • Santa Clara County, Cal. • Convair Division, General Dynamics • City of Milwaukee, Wis. American Cab Co., Kansas City • State of Minnesota

HERE ARE THE REASONS WHY THE NEW FLEET-SIZE LARKS ARE GOING PLACES IN '62

- **NEW 113" WHEELBASE,** 5 inches longer than Rambler Classic, gives luxurious ride and room . . . a bigger car than any other at the same price.
- **NEW INTERIOR DIMENSIONS** provide legroom comparable to Cadillac—over 6 inches more legroom than Plymouth, over 12 inches more than Corvair Monza!
- **NEW HEADROOM** in front is 40"—a full inch higher than the Fairlane. New headroom in back is 39½"—a full inch and a half higher than the Fairlane. (When we say "room for six-footers" we **mean it.)**
- **FLEET-PROVED POWER** in lively Six or choice of two V-8's—112 to 225 HP! Five body styles to choose from, with wide choice of trim, colors and options—the widest offered by any manufacturer!
- **NEW FINE-LINE STYLING,** a longer car with smart European design, wins quick acceptance with fleet-car drivers. Glamor-styled but taxi-tough!
- **GO-ANYWHERE STAMINA,** with high ground clearance—even on off-highway trails, The Lark takes the most beating with least complaint. Heavy Duty equipment is available on every model.
- **COMPACT SIZE PRICE TAG** on the Fleet-size Lark—only the first of many savings! Lowest maintenance and repair have been proved in Lark fleets across the country, for years. Endurance-built quality keeps operational costs low... keeps trade-in value right up among the top few makes!

new **'62 LARK**
BY STUDEBAKER

GET THIS VALUABLE INFORMATION RIGHT NOW! EW12-62-2

Send me all the data on the '62 Fleet-size LARK.

Name_____

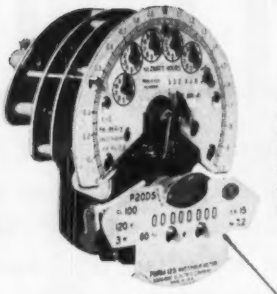
Title_____

Company_____

Address_____

City_____ Zone_____ State_____

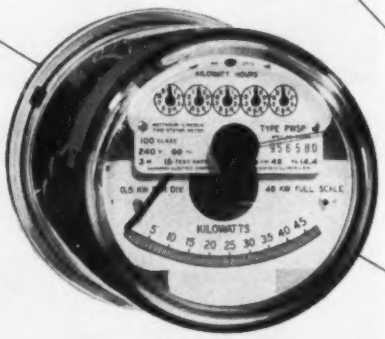
Mail to: A. E. Fitzpatrick, Studebaker Fleet Department, South Bend, Indiana.



DR (dual range) mechanical demand registers reduce register change-outs, cut inventory costs, let you double the demand range as the load grows.

Sangamo's P20 and P30 are the most modern and advanced two and three stator meters. They provide the highly sustained accuracy needed to better measure today's large loads.

NEW VALUES IN POLYPHASE METERING

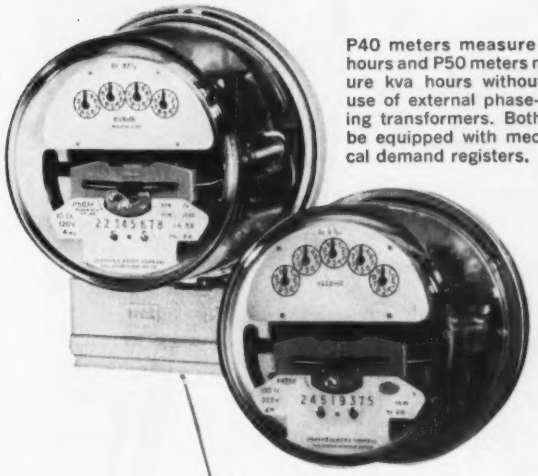


PW (combination kwh/thermal kw demand meters) have dual range designed to keep abreast of your growing loads.

Universal metering equipment with the P60S universal meter and UM meter mounts (UM-1 with CT's and PT's—UM-2 for external transformers) attain real savings through standardized metering on all conventional services.

Sangamo Autopass metering equipment provides positive secondary circuit opening and closing on transformer-rated installations. It combines "C" base 2 and 3 stator Class 10 meters with the UM-2 meter mount.

Take a look at what's new in polyphase metering—the most complete, most advanced line of meters and associated equipment! Developed by Sangamo to meet your current needs and to anticipate your future requirements.

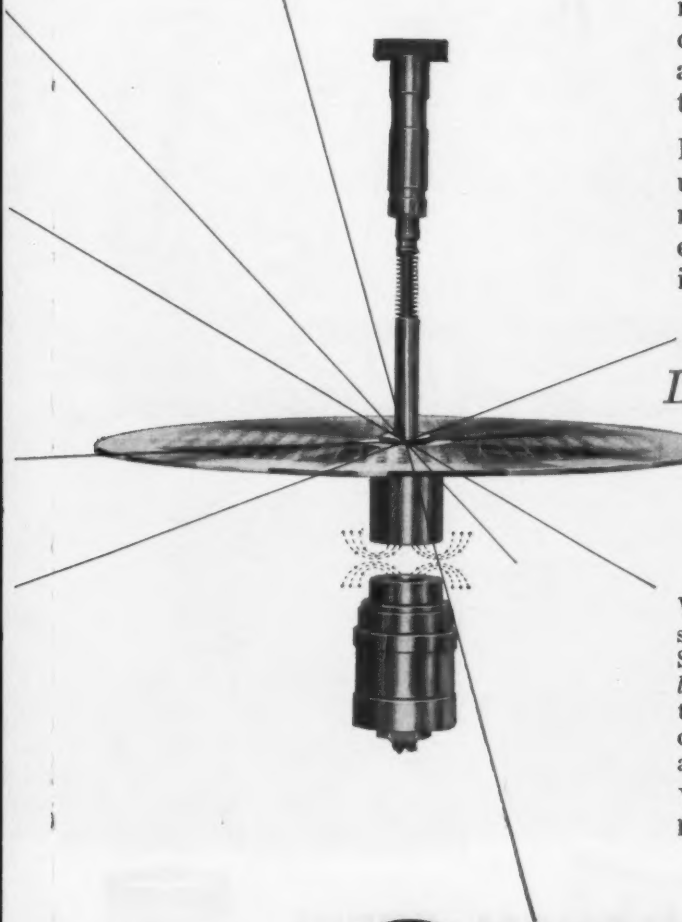


P40 meters measure kvar hours and P50 meters measure kva hours without the use of external phase-shifting transformers. Both can be equipped with mechanical demand registers.

All of these two and three stator meters have *true magnetic flotation* . . . the moving system that floats freely and permanently on a magnetic field created by specially bonded Alnico magnets. All retain the proven Sangamo advantages of slow speed and high torque to give you polyphase meters with unexcelled sustained accuracy. All are small and compact—the P30, for example, is the lightest, smallest three stator meter . . . the only one with single disk, round cover design. All feature sectionalized construction, interchangeable components, and easy-to-use adjustments.

Dual range mechanical demand registers are available for every type, and most thermal demand meters feature dual range. On Sangamo demand meters, you can double the range with a screwdriver, quickly and easily—no recalibration is necessary.

Entirely new metering concepts offer many unique benefits. Investigate Sangamo's universal meter and meter mounts. Consider Autopass equipment for your polyphase transformer-rated installations • • •



LOOK TO SANGAMO FIRST
for all of your
polyphase metering needs

When you need polyphase meters, remember the outstanding values that are yours when you specify Sangamo. Remember also that this is *the most complete line* of kwh, kvarhr and kvahr self-contained and transformer-rated meters, in both socket and bottom-connected construction, with dual range mechanical and thermal demand.

Your Sangamo Representative can give you the complete story on these new developments.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

PW61-7

Building New York's "Kilowatt Turnpike"

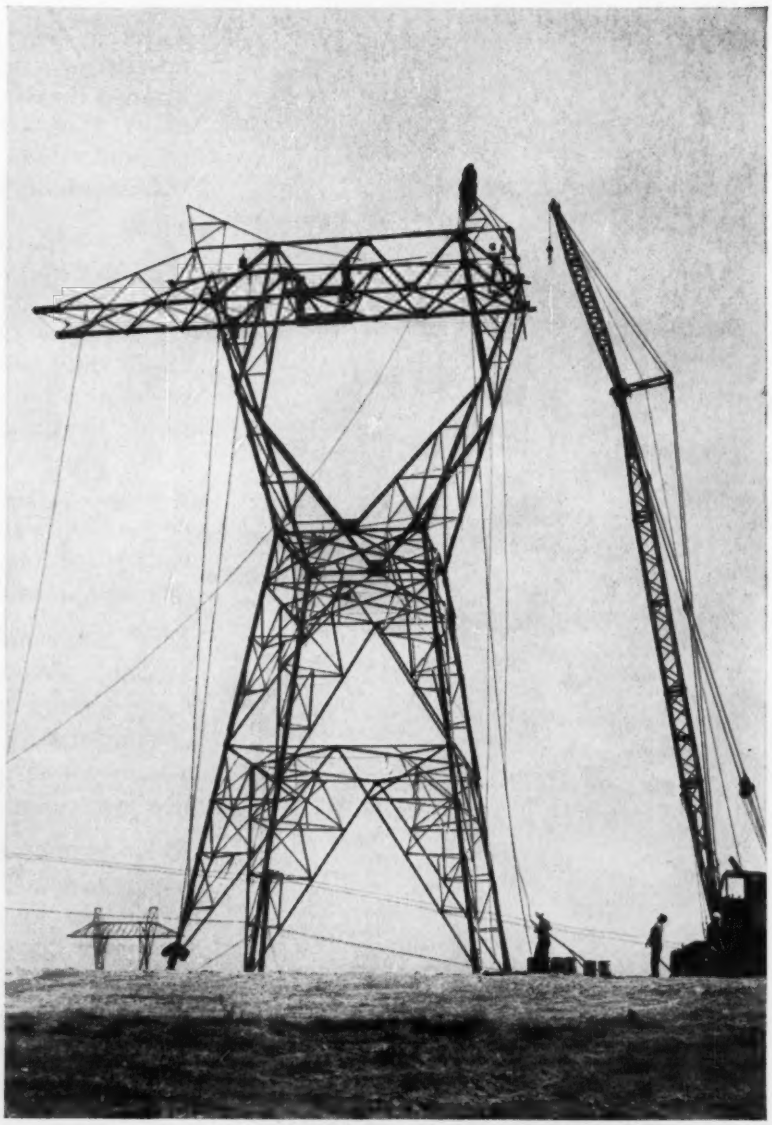
Bethlehem Steel supplies 1,370 345-kv towers for 150 miles of line from Utica to Pleasant Valley

A tremendous power grid is going up in New York State, overlaying existing 115-kv lines with high-capacity 230 and 345-kv circuits.

345-KV HIGHWAY . . . Perhaps the most spectacular phase of the entire project is construction of a 345-kv power "highway," extending from the Niagara River eastward to Albany, then south to Yonkers, a total of some 410 miles. Of this portion, Niagara Mohawk Power Corporation is building the sections extending 83 miles from Edic Station (Utica) to a new substation at New Scotland (Albany), and thence about 65 miles to Pleasant Valley, near Poughkeepsie—the latter section requiring dual lines. The total project called for 1,370 galvanized steel towers, supplied by Bethlehem.

LIGHTWEIGHT TOWERS . . . Commonwealth Associates, Inc., designed the towers for economy consistent with sound engineering. The normal tangent towers are of the waist type, single circuit, having rectangular bases with a transverse face of 24 ft, and a line face of only 6 ft 6 in. They weigh only about 3.5 tons. Average height is 86 ft, with the ruling span 900 ft.

FABRICATED AT LEETSDALE . . . The towers were fabricated and galvanized at Bethlehem's Leetsdale Works, for decades the nation's Number One supplier of towers and switchyard structures. West Coast requirements are served by our tower shops at South San Francisco, Calif., and Seattle, Wash.

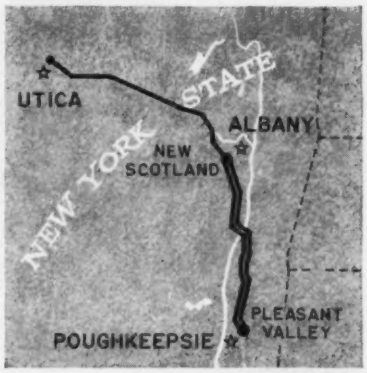


Erecting a heavy angle tower for the dual line extending southward from New Scotland, N.Y., some 26 miles to a Hudson River Crossing. Contractor here is Collier Construction Company of Strongsville, Ohio.

Steel *for Strength . . . Economy . . . Versatility*

If you're in the market for transmission structures, we urge you to call on the services of the Bethlehem sales office nearest you.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation



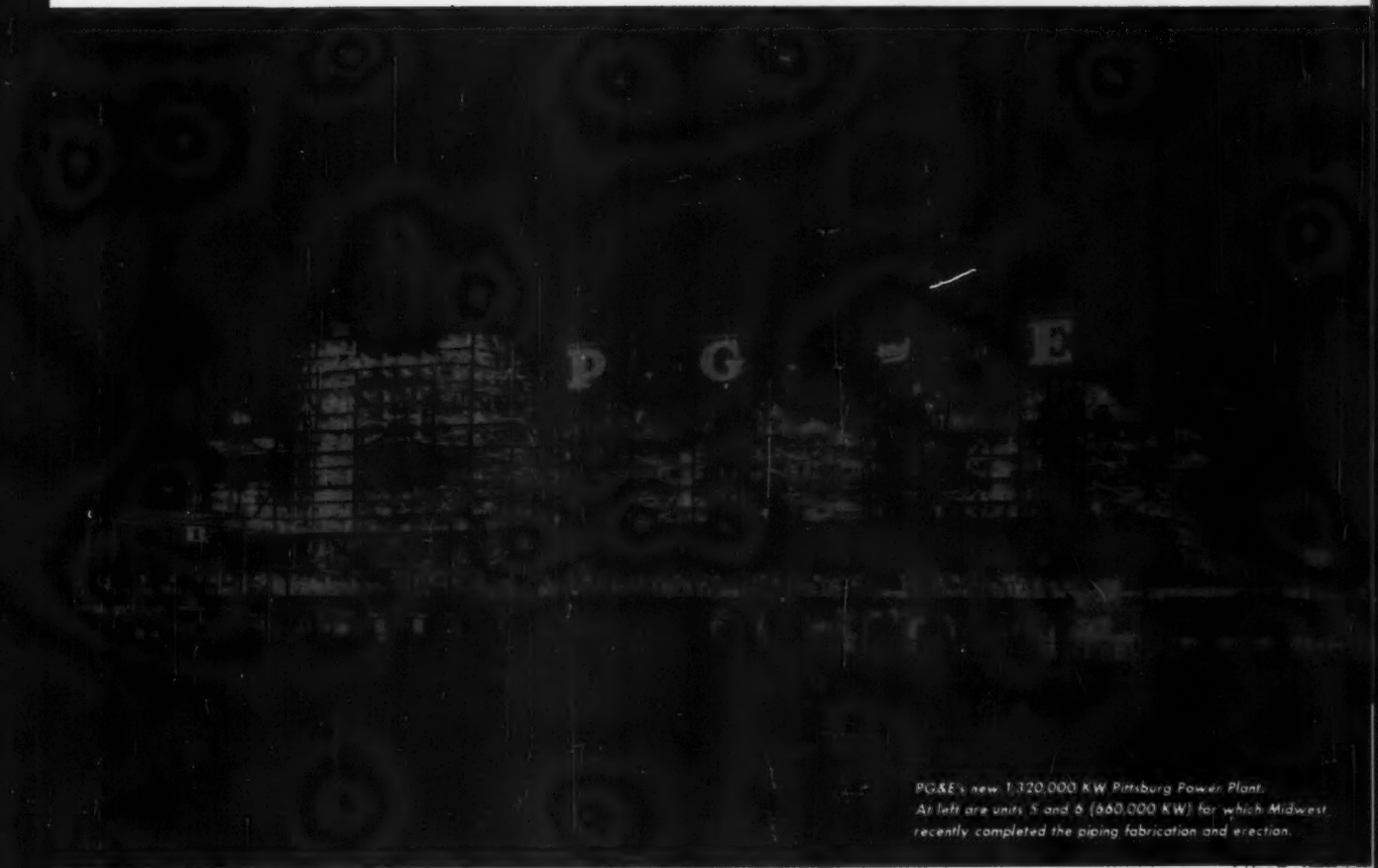
BETHLEHEM STEEL

BETHLEHEM STEEL

NEW PG&E UNITS PIPED BY MIDWEST

Pacific Gas and Electric Company, serving the rapidly growing region of Northern and Central California, has added 3,615,500 KW of steam plant capacity since World War II alone. Another 720,000 KW is scheduled for completion by mid-1963. Midwest is proud to have been the piping fabricator and/or erector for most of the new or expanded plant capacity completed to date or under contract, and to have been selected as the fabricator and erector for PG&E's newest project—units 3 and 4 at Morro Bay Station. In all, PG&E will have 26 generating units in 7 plants benefiting from power piping by Midwest!

For an illustrated booklet on Midwest's capabilities in piping, write for Bulletin 60B, POWER AND PROCESS PIPING.



PG&E's new 1,320,000 KW Pittsburg Power Plant. At left are units 5 and 6 (660,000 KW) for which Midwest recently completed the piping fabrication and erection.

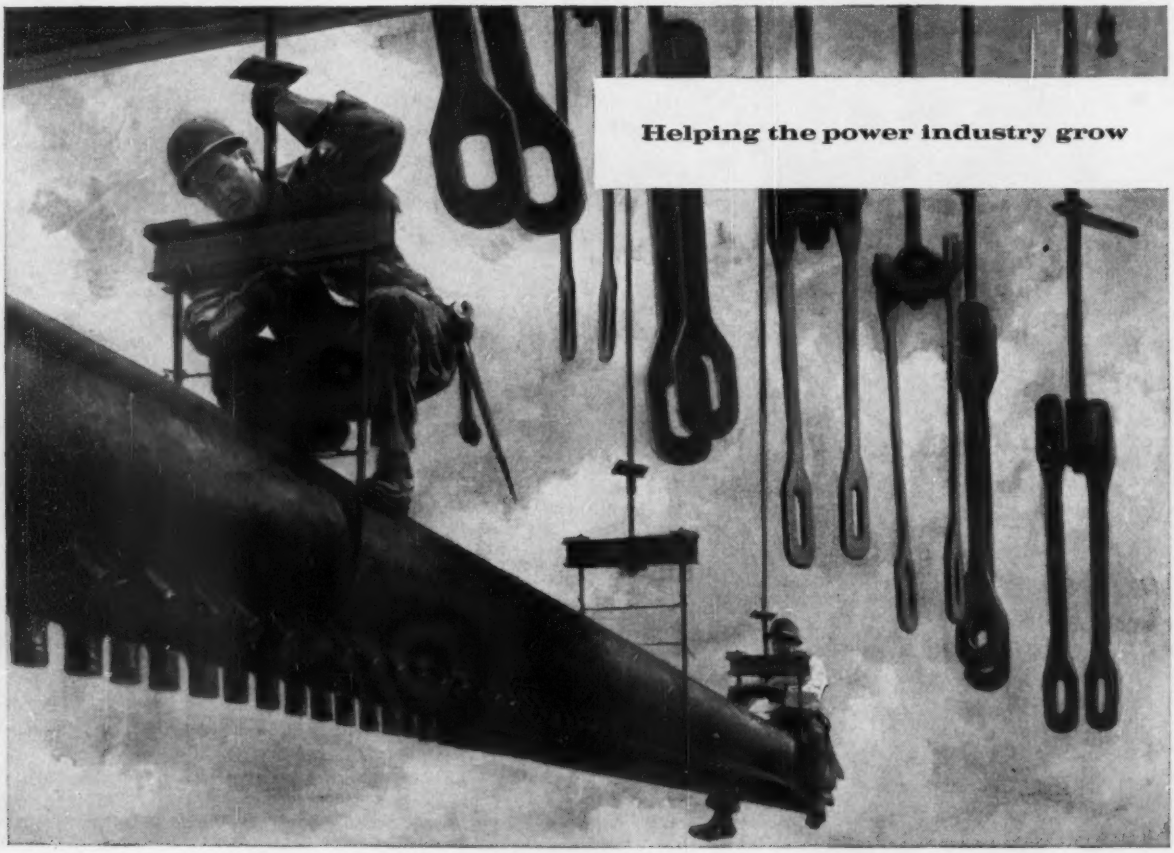
A Division of Crane Co. / *1450 South Second Street, St. Louis 4, Missouri*

MIDWEST PIPING

Hanging a header

The great steel caterpillar being hung by the construction workers is actually a header, integral with a steam generating system, and its blunt cylindrical feet are points of entry for vertical tubes. In the foreground dangle empty-eyed brackets waiting for a bigger and heavier header. From coast to coast the engineers, draftsmen, electrical workers, and construction men of United Engineers have completed projects of wide size and variety. Each assignment has demonstrated our ability to operate within a budget and on schedule. We invite you to draw on our background of 75 years' experience as designers, construction engineers, and engineering consultants. Whatever the assignment — power or processing plant, steel mill, industrial or utility installation — you can safely translate experience in terms of savings.

Painting by Robert Lavin



Helping the power industry grow

UNITED ENGINEERS

& Constructors Inc. • U.E.&C. (Canada) Ltd. • New York • PHILADELPHIA • Chicago

PROTECT YOUR EXPENSIVE OVERHEAD EQUIPMENT WITH

WEAVER GROUNDS

Leading Electric Utilities Specify WEAVER Equipment for Long-lasting, Trouble-free Grounding

GROUND RODS

Heavy, uniform copper coating, molecularly bonded to a rigid steel core, assures permanent grounding. The copper is work-hardened and resists scarring in rocky soil. A special draw gives the core more rigidity and with machined point driving is easier . . . chamfered top eliminates mushrooming and splitting.

GROUND ROD CLAMPS

Cast of high-strength, silicon aluminum bronze, yet cost no more than extruded types of clamps. Design guarantees perfect alignment between ground wire and rod. Big half-inch screw with rounded point gives high pressure contact without damaging the copper on the rod . . . machine-cut threads withstand high torque without stripping or breaking. Available with socket or square heads.

POLE BOTTOM GROUND PLATES

Weaver Plates with 25% more copper area than other types of plates, provide better overload dispersal . . . yet cost no more. It is the only plate with a heavy duty cast bronze connector to give high pressure contact between plate and ground wire . . . assures long-lasting, safe grounding.

J. A. WEAVER Company

Ask Your Electrical Wholesaler for WEAVER Grounding Equipment

2110 Howard Street • St. Louis 6, Mo. • OAKfield 1-6336

Read about the most important development

A recent Cyclone Fence development promises to revolutionize industrial fencing throughout the United States. After years of vigorous research, and production line debugging, we are manufacturing an aluminum-coated steel fence of such high quality that we are willing to give it the Cyclone name. Nine years of field testing indicate that no other type of fence can economically match Cyclone Aluminum-Coated Fence's combination of corrosion resistance, tensile strength and heat resistance. Yet the price is only slightly above first-quality galvanized steel fence.

FIRE RESISTANCE

In a brush or debris fire, not uncommon along a fence line, temperatures can easily climb to the 1,300° mark. If the fence fabric melts, your property protection goes with it. The steel in Cyclone Aluminum-Coated Fence will not melt at temperatures below 2,850°. Repeated tests have shown that our aluminum-coated fabric can withstand temperatures as high as 1,650° and still retain its protective coating, and 2,000° for brief periods without the destruction of a single strand of wire.

STRENGTH

The steel wire used in Cyclone Aluminum-Coated Fence has a minimum tensile strength of 80,000 psi, and that strength is retained as long as the coating remains intact. What does this strength mean to you? In actual tests, USS Cyclone Aluminum-Coated Fence was rammed by a car traveling at 35 mph. Not a single strand of wire was broken. ■ Buyers must not underestimate the necessity for strength in industrial fence. If you could "fence your fence" to protect it there would be no problems. But fence has to stand alone, and withstand vandals, side-swiping vehicles, and all sorts of mechanical abuse.

Protect it with USS CYCLONE

in the history of property protection fence

CORROSION RESISTANCE

Our Research and Metallurgical people have found accelerated weathering and salt spray tests are misleading, therefore the following data is from actual service records: After 9 years of continuous exposure to a severe industrial atmosphere (Cleveland), Cyclone Aluminum-Coated Fence shows practically no deterioration. Even after 9 years of severe marine exposure, 90% of the surface was free of corrosion.

PRICE

The normal market prices for USS Cyclone Aluminum-Coated Fence are only slightly above prices for galvanized chain link fence. And remember, for this very slight premium you're getting the combination of aluminum and steel that gives you superior corrosion resistance and long lasting strength.

KNOW THE BRAND

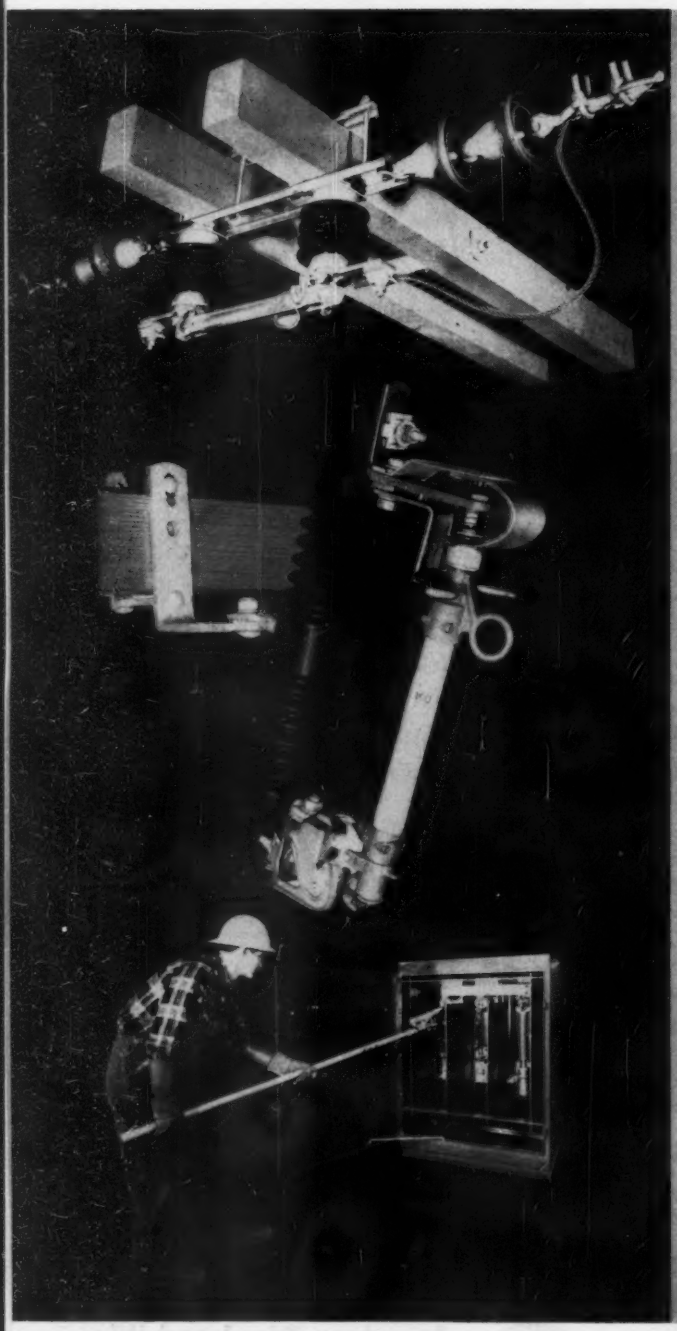
Cyclone is a brand name, not a type of fence. When you buy USS Cyclone you're getting a fence that's pre-engineered, prefabricated down to its smallest part. The Cyclone-developed H-Post is built like a steel beam for extra strength; Cyclone gates are sleeve-constructed—not welded—so they can be easily repaired; one-quality, full-weight fabric; deep-set post installations that don't skimp on concrete or steel, and professional installation by long-time Cyclone crewmen who know how to put up a fence to stay. ■ USS Cyclone has sales offices all over the country and a reputation built on the fact that Cyclone is the most widely used property protection fence in the world. Cyclone Fence is backed by the American Steel and Wire Division of United States Steel—a company that will be around tomorrow to live with what it sells today. ■ 69 CYCLONE BRANCH OFFICES. Cyclone has 69 branch offices throughout the country. Which means, wherever you are, we're reasonably close by. Give us a call next time you need fence around your company's property. Check your Yellow Pages under "Fence." For a brochure on new Cyclone Aluminum-Coated Fence, write American Steel and Wire, Rockefeller Building, Cleveland 13, Ohio.

USS and Cyclone are registered trademarks.

For safety, dependability, economy.

American Steel and Wire Division of United States Steel

Loadbuster works with all four



Portable loadbreak tool is usable with cutouts, disconnects, power fuses, and pad mounted gear

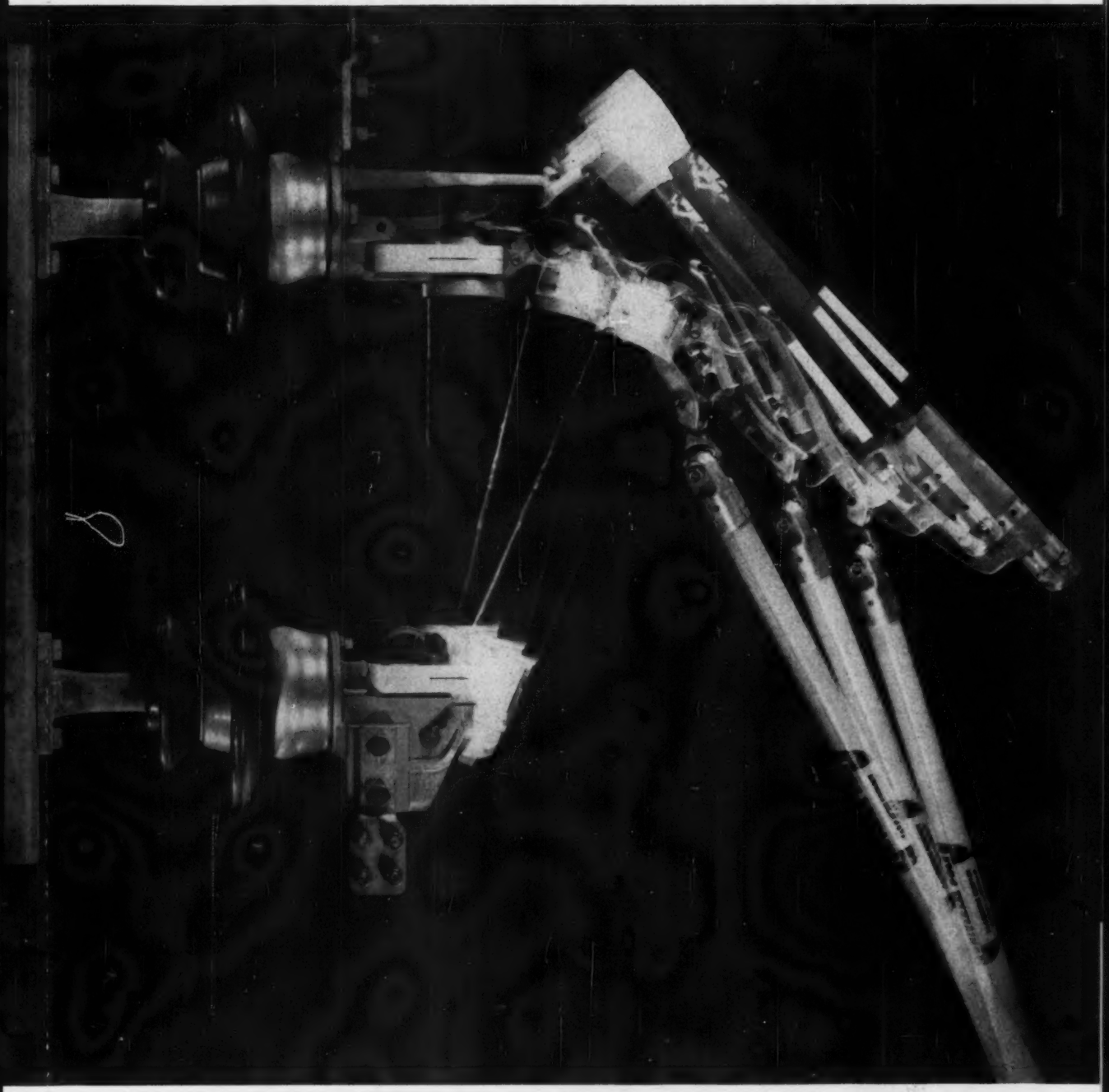
Loadbuster, S&C's portable loadbreak tool, earns its own way by providing truly unlimited load switching when and where it's needed. With its load switching range through 400 amperes at any system voltage through 14.4 kv, Loadbuster works with cutouts, disconnects, power fuses, and pad mounted gear.

Within its voltage range, Loadbuster can interrupt full loads through 400 amperes, all associated magnetizing and line charging currents, and can switch all typical capacitor banks. Thus, this easy-to-carry switching device:

- Replaces link break cutouts
- Provides full load switching for cutouts and power fuses
- Replaces group operated disconnects with stick operated disconnects at sectionalizing points
- Provides full load switching for hookstick disconnects
- Replaces load interrupter switches where group operation is unnecessary
- Brings overhead switching practices to residential underground

Loadbuster's portability, versatility, and long operating life (it's designed for daily field usage) have made it standard equipment on many utility service trucks. Ask your S&C representative for a demonstration of how Loadbuster can cut your operating costs.

S&C ELECTRIC COMPANY
4421 Ravenswood Avenue • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911



You simply hook Loadbuster across the upper contact of a disconnect or fuse and open it in the normal way. There is no arc, link breakage, contact burning, or danger to the operator. Just disengage the device and it's ready for instant use again,

A First in Economic Dispatching

PHILADELPHIA ELECTRIC'S DIGITAL

Control Console functions as the nerve center for Philadelphia Electric's digital computer-directed economic dispatch system. From this console, power directors operate and supervise the loading of 34 steam and hydro generating units with a combined capacity of 3500 MW. Console is located in the utility's dispatching center in midcity Philadelphia.

COMPUTER-DIRECTED CONTROL SYSTEM

In its new economic dispatch system—the first of its kind in the utility industry—Philadelphia Electric Company combines an industrial digital computer with high-speed analog control elements to automatically assign generation. Developed jointly by Honeywell and Philadelphia Electric, the new system not only assigns generation for minimum incremental cost, but also computes tie-line interconnection billing data and solves other problems relating to power system operation.

Here are a few of the operating advantages the digital computer-directed system brings to Philadelphia Electric's extensive generating network:

1. The digital approach aids in modifying the control system as the power network changes or grows. Advances in the control art can be set into the computer by routine changes in the machine's program. This benefit can be realized only with digital computer-control.

2. The efficiency characteristics of each generating unit can be followed with greater accuracy.

3. By considering both positive and negative slopes in unit incremental cost curves, the new system provides cost savings for Philadelphia Electric and other utilities who may use the Honeywell system to control valve point openings with their accompanying negative slopes in loading steam turbines. The use of analog equipment would necessitate a compromise between actual and programmed curves.

The system is designed for highest reliability with full consideration given to human engineering factors. Circuitry is all solid-state. System amplifiers, governor motor actuators, and rate limiters replace motors, servos, slidewires and vacuum tubes.

In the Philadelphia Electric dispatch system *all basic elements and virtually all the components*—from precision switches and meters to the computer and control console—were produced by a single manufacturer—*Honeywell*. Because of the integrated capabilities of its Industrial Products Group, Honeywell has been able to provide Philadelphia Electric with the world's most advanced economic dispatch control system.

For information on what Honeywell's Industrial Products Group can do for you, contact your nearest Honeywell field engineer. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pennsylvania. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

Honeywell 290 Digital Computer combines with high-speed analog control elements to assign generation at minimum incremental cost. In making allocations, computer operates unattended and bases calculations on incremental production cost curves, fuel costs, performance characteristics, transmission losses and other information. Computer's instructions are then telemetered to power stations. Every ten seconds, the computer samples desired steam generation and makes new economic calculations which reset assigned generation among units. On command, the computer shares the control function with that of interconnection billing computation.

Station Consoles, located in each of Philadelphia Electric's nine plants, permit setting of the generating units' high and low limits and their rate of change based on operating conditions.

Honeywell

First in Control

HONEYWELL INTERNATIONAL Sales and Service offices in principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

Rating shown
34.5 KV, 1200 Amperes

Ultra-modern high momentary

NEW! from Kearney

AR-60-P POWER CLASS SWITCH

....easy to install....quick adjustment

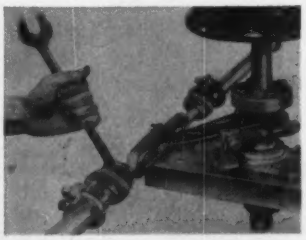
The Kearney AR-60-P rotating insulator, vertical break switch is equally at home in a substation or pole top—wherever heavy-duty performance is required. Delivers NEMA-PLUS efficiency under both normal full loading and severe short circuit stress.

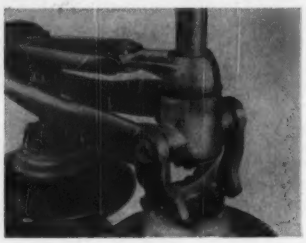
The AR-60-P is economical—offers considerable savings in installation and adjustment time.

Check these high performance features:

Reverse-loop contacts
Enclosed hinge end contacts
In-line, straight through current path
Rotating blade breaks ice, dirt, corrosion
High pressure silver-to-silver contacts
Weatherproof rotating stack bearing

Available in ratings of 7.5 KV through 69KV in 600, 1200 and 2000 amperes. Ask your Kearney representative or write the factory for all the details on this new family of rugged power class switches.





Unmatched ease and speed of adjustment are provided by the unique inter-phase clevis design. A wrench is all you need for "in-the-air" vernier inter-phase link adjustment . . . without removal of the clevis pin.

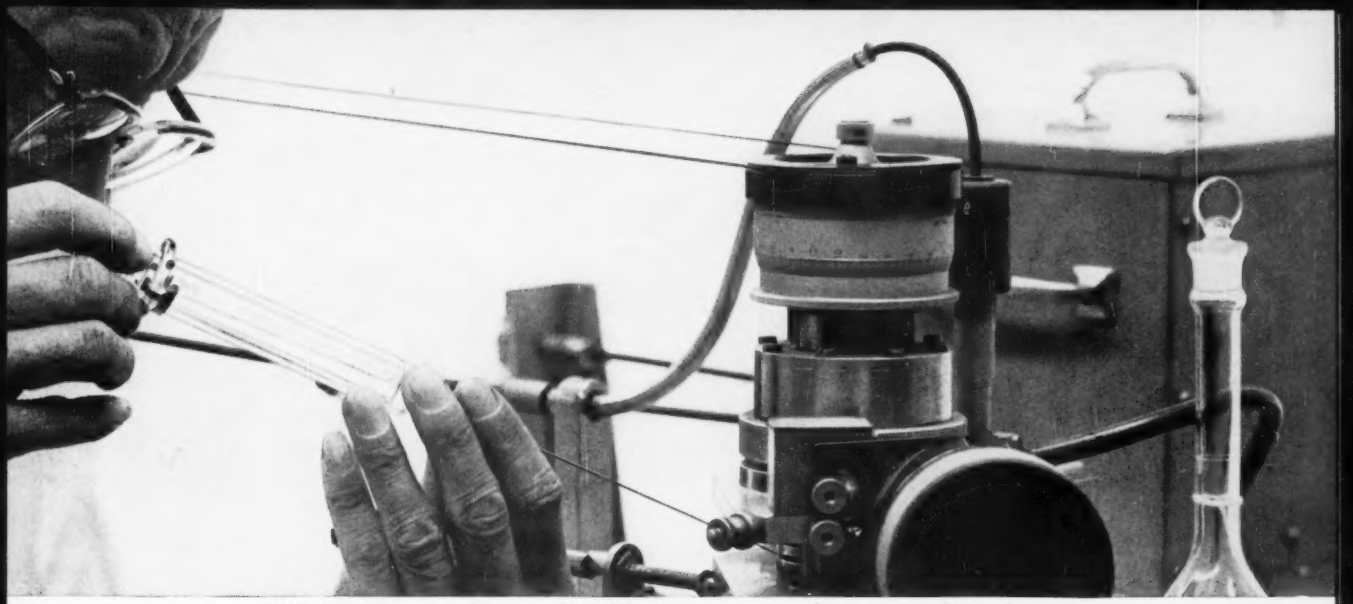
The hinge contact is completely enclosed to prevent corrosion and avoid maintenance. Its design provides full engagement during entire motion of the blade.

KEARNEY

JAMES R. KEARNEY CORPORATION

MELROSE PARK DIVISION • 25TH & DIVISION STS., MELROSE PARK, ILL.

PLANTS IN ST. LOUIS • MELROSE PARK, ILL. • FAYETTEVILLE, ARK. • GUELPH, ONT., CANADA • ST. THERESE, QUEBEC, CANADA



Diala Oil AX is carefully injected into laboratory equipment that measures electrical properties of the oil. This is one of the ways Shell makes sure that dielectric strength is high.

BULLETIN:

Shell reveals how Diala Oil AX lasts up to 5 times longer than ordinary oils

Only an oxidation-inhibited transformer oil of exceptional quality can be expected to give long service life under today's severe operating conditions.

That's why a growing number of utilities are switching to Shell Diala Oil AX. Read how Diala® AX helps them hold costs down—and how it can do the same for you.

THE DISTRIBUTION transformer is of constant concern to most utilities. It often operates outside its rated capacity during peak periods. Temperatures run high. And transformer maintenance costs are on the rise.

All of these factors have prompted utilities to search for a stable transformer oil that can help protect overloaded equipment, extend transformer life and reduce maintenance.

The answer for many utilities: Shell Diala Oil AX.

What Diala does

Diala AX contains a special Shell-developed oxidation inhibitor.

Accelerated laboratory oxidation tests show that Diala AX can provide satisfactory service *up to five times as long as* uninhibited oils.

Because of the oxidation inhibitor in Diala AX—and also because of Shell's selected base stocks and refining techniques—this remarkable transformer oil is exceptionally stable. It resists sludge formation. It helps prevent the creation of metal-attacking acids. And it reduces peroxide build-up which can damage many types of insulating materials.

Diala AX has also demonstrated an ability to extend the life of fabric insulation materials. In Shell's Emeryville, California laboratory, scientists soaked cotton insulating threads in many different oxidized oils—and for varying periods.

Conventional oils, when oxidized, weakened the thread by 25 to 40%. When subjected to the same oxidizing treatment, Diala AX had negligible effect on the thread's strength.

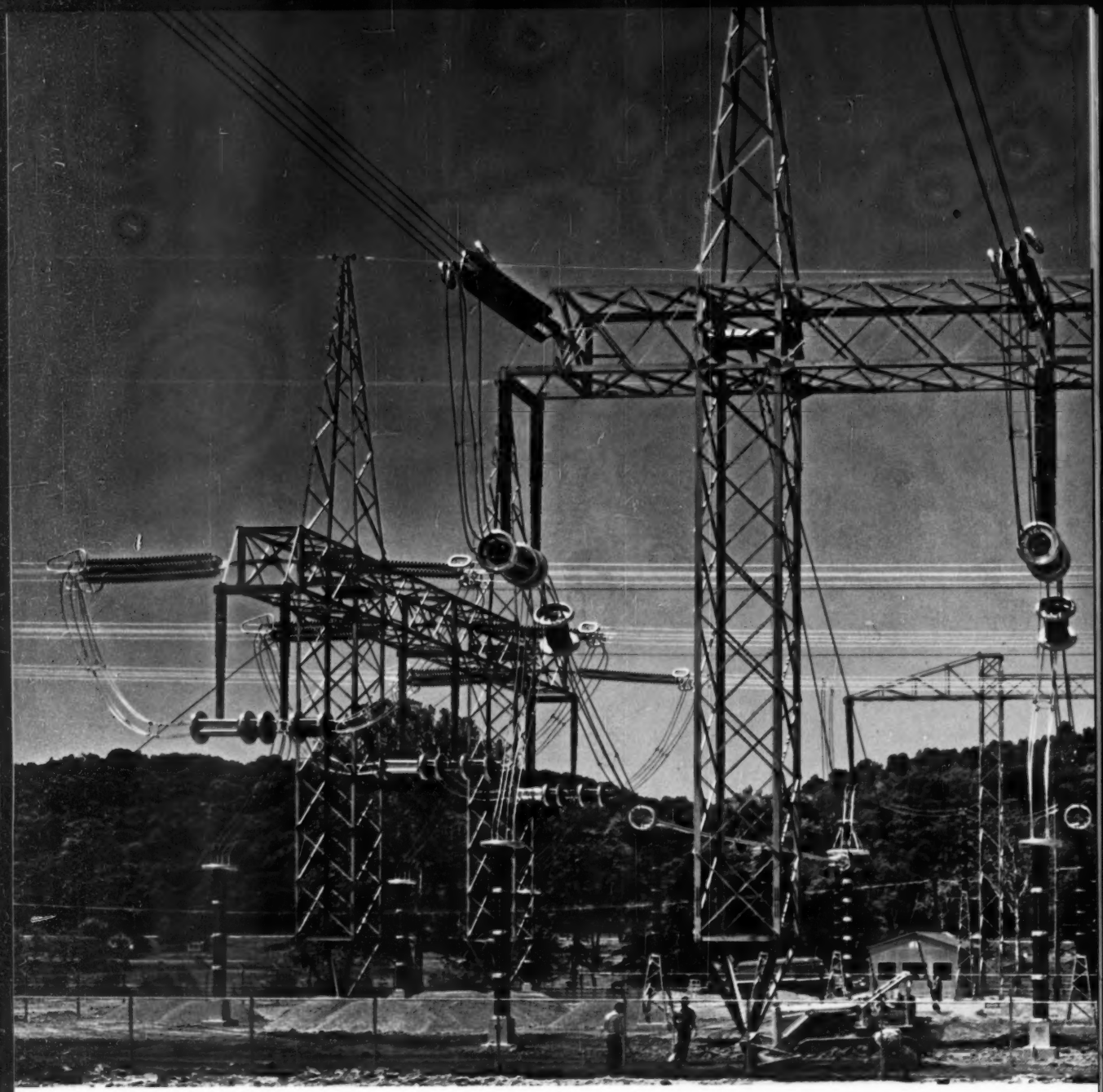
Diala AX has excellent dielectric properties (see photo above), good heat transfer characteristics and a very low pour point. Its low volatility reduces evaporation loss. And its flash point is high for maximum safety.

Call your Shell Representative

Ask your Shell Industrial Products Representative for all the facts on Diala AX. Or write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y.

SHELL

A BULLETIN FROM SHELL
— where 1,997 scientists are working to provide better products for industry



Apple Grove, W.Va.
June 22, 1961—
Westinghouse
and American Electric
Power threw the switch on
a prototype 750kv line

APPLE GROVE advances the art of Extra High Voltage transmission.

The 750-kv transmission test project at Apple Grove will save electric utilities millions of dollars in the future. Research conducted here will evaluate new techniques and equipment developed by Westinghouse for EHV transmission of huge blocks of power.

Research objectives are:

SIMULTANEOUS comparison of radio influence and corona loss performance of 2 conductor diameters in 3 different configurations under identical atmospheric conditions.

EVALUATION of mechanical features of sub-station, towers, conductors and hardware.

EVALUATION of electrical features of transformer, arresters, coupling capacitors and conductors.

EHV lowers the cost of transmitting bulk power:

REDUCES power line losses.

REDUCES capital cost of transmission facilities.

REDUCES need for new rights of way.

EHV interconnections permit more efficient power pooling:

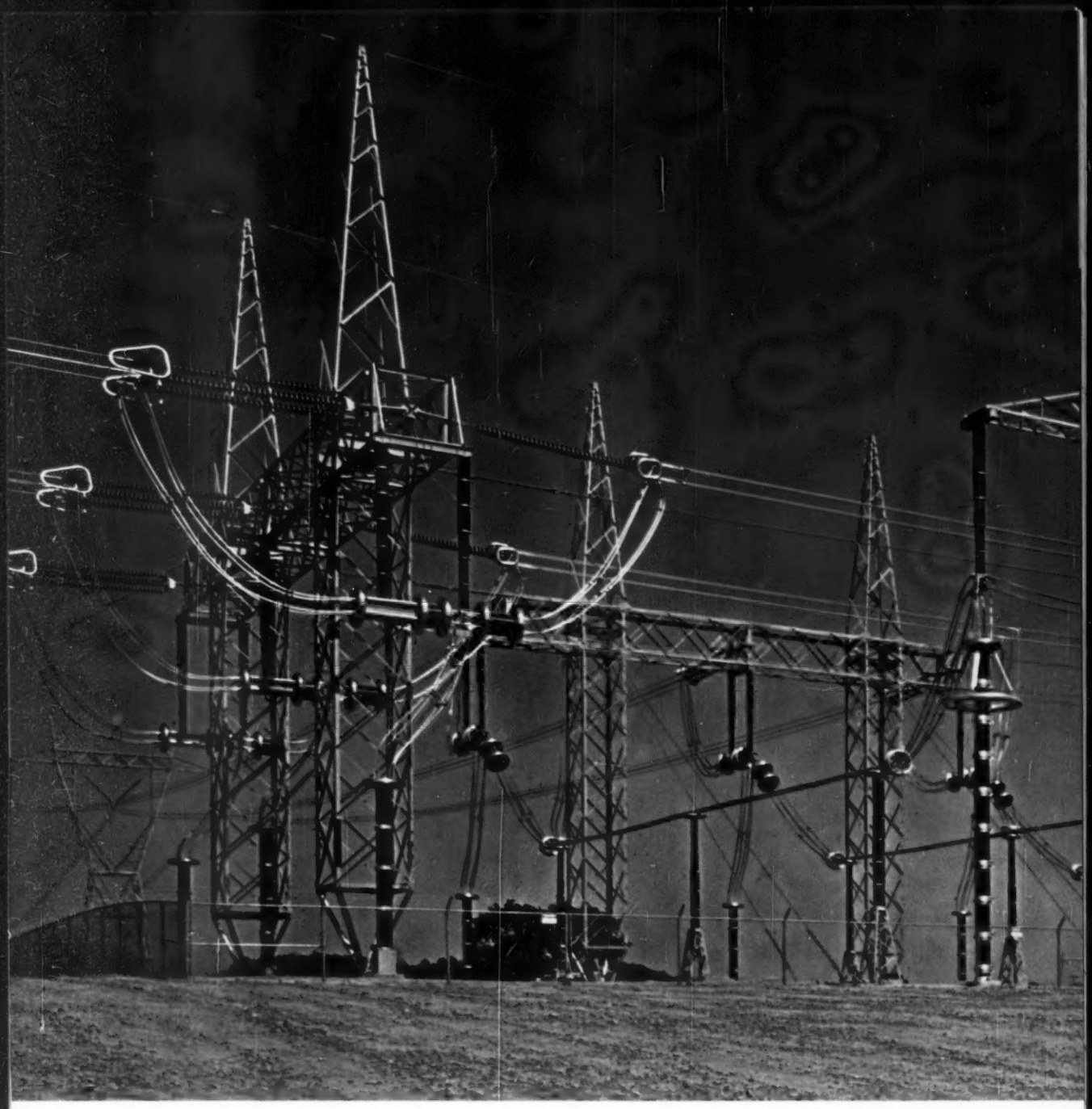
REDUCES amount of generating capacity now tied up as reserve for peak loads and reliable service.

REDUCES capital cost of new generating capacity through the application of larger units.

REDUCES generating cost through improved efficiency of larger units.

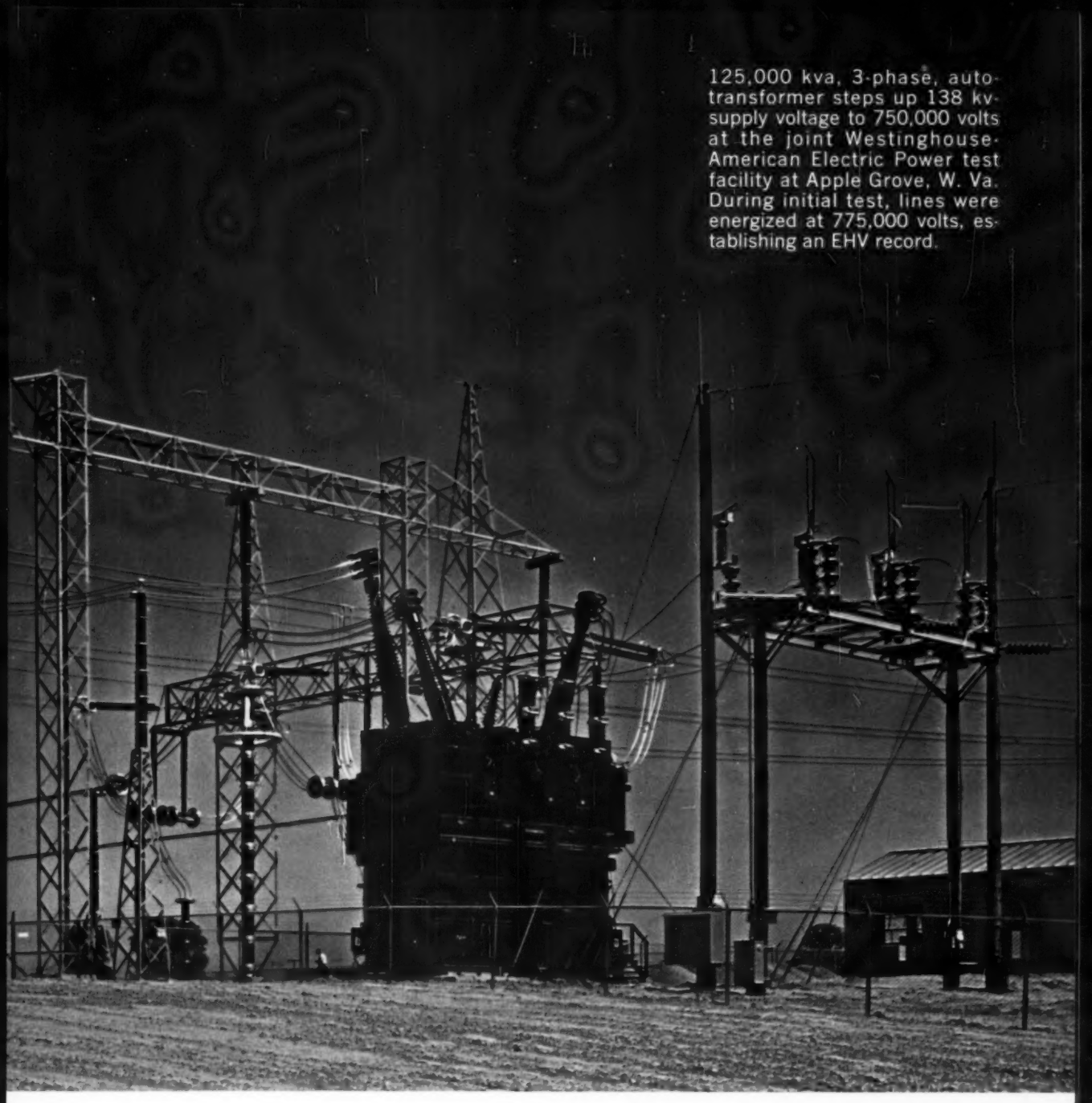
REDUCES generating cost by locating plants close to lower cost fuel.

IMPROVES economic tie-line dispatch.



Apple Grove, W.Va.
Westinghouse transformers are ready now to power tomorrow's EHV lines

Westinghouse has pioneered the technical developments which have lead to the high voltage transmission systems of today. In particular, EHV transmission of the future presents no problems for Westinghouse transformers. The exclusive "Form-Fit"® corona-free design with forced oil cooling, close-fitting tank and vertical coil construction result in EHV transformers that are both smaller and lighter per kva making possible the manufacture of capacities necessary for the ever larger stations of tomorrow. Westinghouse transformers are ready now to serve any foreseeable voltage level—meeting the challenge of the super-voltage future.



125,000 kva, 3-phase, auto-transformer steps up 138 kv-supply voltage to 750,000 volts at the joint Westinghouse-American Electric Power test facility at Apple Grove, W. Va. During initial test, lines were energized at 775,000 volts, establishing an EHV record.

Since 1886—Westinghouse "Contributions" help electric utilities keep pace with America's growing power needs.

1886 George Westinghouse introduced first A.C. transformer into the United States.

1890 first 3000 volt A.C. system installed at Portland, Oregon.

1897 first 40,000 volt transformer.

1907 first condenser bushing — an Industry standard today.

1921 first 220,000 volt transformer.

1932 introduced vacuum filling and corona-free design. Pioneered impulse testing—confirmed high voltage designs. Introduced Hipersil, grain oriented core materials. Introduced forced-oil cooling to increase transformer loading 66⅔%.

1935 built the 287,000 volt Hoover Dam transformers—highest transmission voltage at that time. Reduced dielectric test level.

1943 introduced "Form-Fit"®, shell form tank, reducing transformer weight and size.

1946 first 500,000 volt experimental transformers used at Tidd EHV Project.

1952 first 345,000 volt commercial installation of power transformers.

1956 built world's largest sound test room.

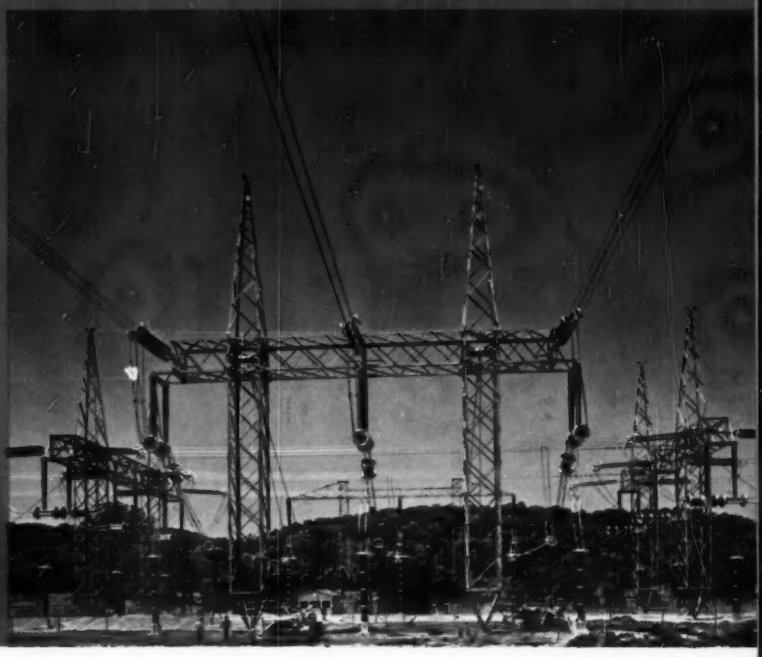
1957 designed and built the first Schnabel railroad car to facilitate transformer shipment. First high altitude EHV tests at Leadville, Colorado.

1958 introduced inner-cooled construction to reduce transformer weight and size up to 25%. Introduced INSULDUR® insulation to permit 10% greater thermal overload capability.

1960 introduced an improved INSULDUR® insulation to permit 12% greater continuous thermal capability at 65°C.

1961 completed design and began construction of 600 MVA transformer—world's largest. Westinghouse and American Electric Power conducted first EHV tests at Apple Grove at a 775,000 volt level.

B



C

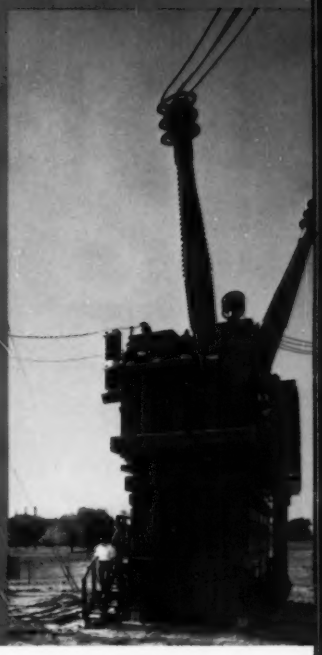
Apple Grove

project is a typical example of
Westinghouse research and development
in meeting America's future power needs.
Such major programs stem
from the support of electric utilities through
their purchase of Westinghouse equipment.
As a result, when you purchase
Westinghouse products you also are helping
provide the knowledge and experience
necessary to build power systems
scaled to the need of the future.
You can be sure . . . if it's Westinghouse.

A

D

E



F

A. Greenhouses contain meters to check radio influence on each line at distances of 100 to 200 feet from center phase. Three meters in each group are all of different design and based on three different theories of radio influence generation.

B. De-couplers block radio-influence (RI) on any one line from interacting with that produced on other two lines, allowing simultaneous independent readings.

C. From central substation, three 2400-foot, 3-phase test lines extend to form a "T". Each line uses different sized, bundled conductors on 18-inch centers. A heating current is carried in each conductor to prevent condensation and simulate actual operation.

D. Three 528-kv station-type lightning arresters protect the 750-kv windings of the auto-transformer from line surges and lightning strokes.

E. Control panel and electronic recorder that logs data from 60 test points at 20-minute intervals. Abnormal readings will automatically reduce interval to every 2 minutes.

F. 125,000 kva, 3-phase auto-transformer steps 138,000-volt supply to 750,000-volt test voltage. Condenser bushings, 24′ in overall height, are rated at 1800-kv BIL.

CP-1065

Westinghouse

Strong Aluminum Base with Bulb Channel Design greatly reduces weight...speeds installation

The light weight aluminum base (1/3 the weight of comparable steel base) provides optimum strength requirements during opening and closing of blade. Mounting bolts can be placed against the crossarms without any interference with insulator caps.

CHANCE *M2A*

the switch specifically designed for sectionalizing Distribution circuits

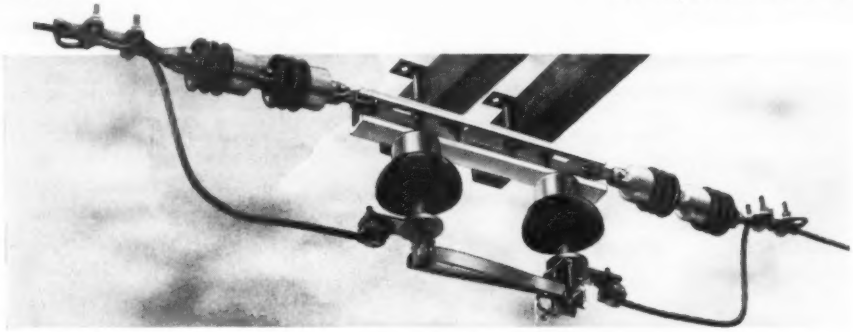
LIGHT BUT RUGGED. Linemen appreciate the light weight of the M2 Switch (the 15 KV, 400 Amp rating weighs but 37 pounds.) This is due to the aluminum base, aluminum cap and pin on the insulators and to design simplicity. The M2 is mechanically strong. A rigid blade and built-in blade guides prevent jamming the blade into an improper closed position, even under considerable side thrust. A positive latch and pry-out is provided on the blade.

SIMPLE TO INSTALL. The M2 Switch can be mounted vertically or underhung, on single or double crossarms. The base has slots separate from the insulator attachments to permit mounting bolts to be placed up close to the crossarm without interference with the insulator cap. There are no complicated adjustments to be made.

SURE AND SAFE. This switch is a reliable conductor when closed and a safe isolator when open. It will operate under the widest range of environmental conditions without damage to the switch or hazard to the operator.

DESIGN COORDINATED WITH DISTRIBUTION REQUIREMENTS.

Open gap spacing for each voltage rating coordinates with the impulse withstand values of the insulators. Current ratings are based on test specifications of NEMA Standards for power switching equipment. The M2 Switch is available in both 200 and 400 amp. sizes for 7.8, 15 and 27 KV ratings.



Designed specifically for pole-top applications, this new Chance disconnecting and sectionalizing switch has the same withstand ratings as fuse cutouts, pole-top regulators, reclosers, and transformers for application to "distribution level" circuits.

To order, see Section 250 in your Chance Catalog, ask your Chance Representative, or write us.

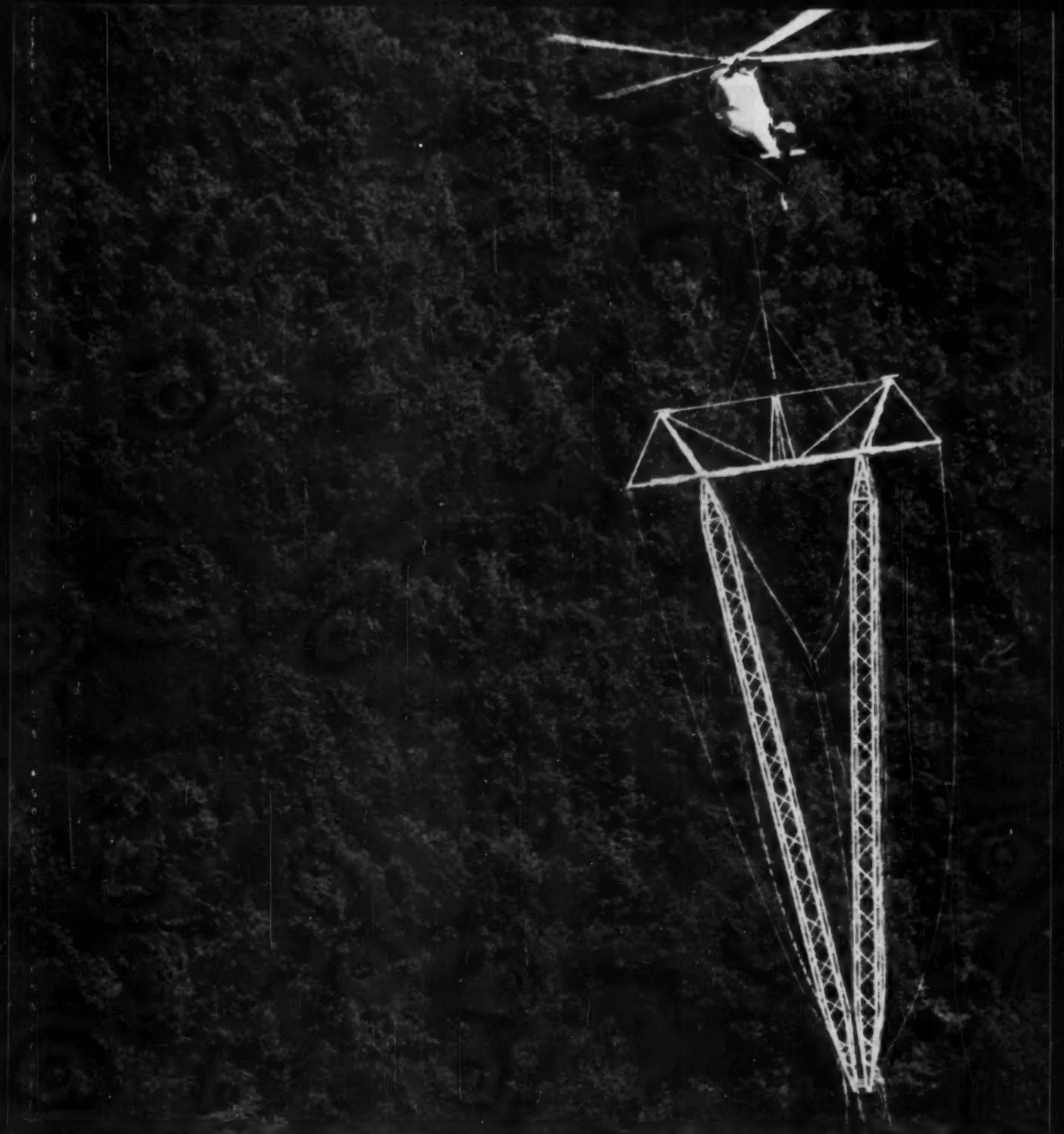
A. B. CHANCE COMPANY

CENTRALIA, MISSOURI

A. B. Chance Co. of Canada, Ltd., Toronto

ABC INDUSTRIES

CS61-34



One minute ago this aluminum tower left the marshalling yard

...in five minutes it will be standing on its foundation

In a history-making experiment in line construction, American Electric Power Company transported and erected a completely assembled V-tower by air.

The aluminum tower, designed for a 138-kv line, was airlifted at the assembly yard, flown 9/10 of a mile, set on its concrete footing, released, bolted and temporarily guyed—all in less than six minutes. With guys, the tower weighed 2,900 pounds—well within the capacity of the Sikorsky S-58 chosen for the job.

The demonstration, conducted by A.E.P.'s subsidiary, Appalachian Power Company, was but one phase of a six-week-long helicopter construction operation. The company used the Sikorsky S-58 to haul steel, poles and assembled H-frames...to erect tower panels ...to string cable. Carrying steel for 17 towers, for example, the helicopter completed what would normally be three weeks' work in just 4¾ hours. Total time to construct 29 miles of line was cut to one-third of that required with conventional methods.

For more facts on helicopter services and the new role of rotorcraft in line construction, simply write Sikorsky.

SIKORSKY AIRCRAFT Division of UNITED AIRCRAFT CORPORATION
Stratford, Connecticut

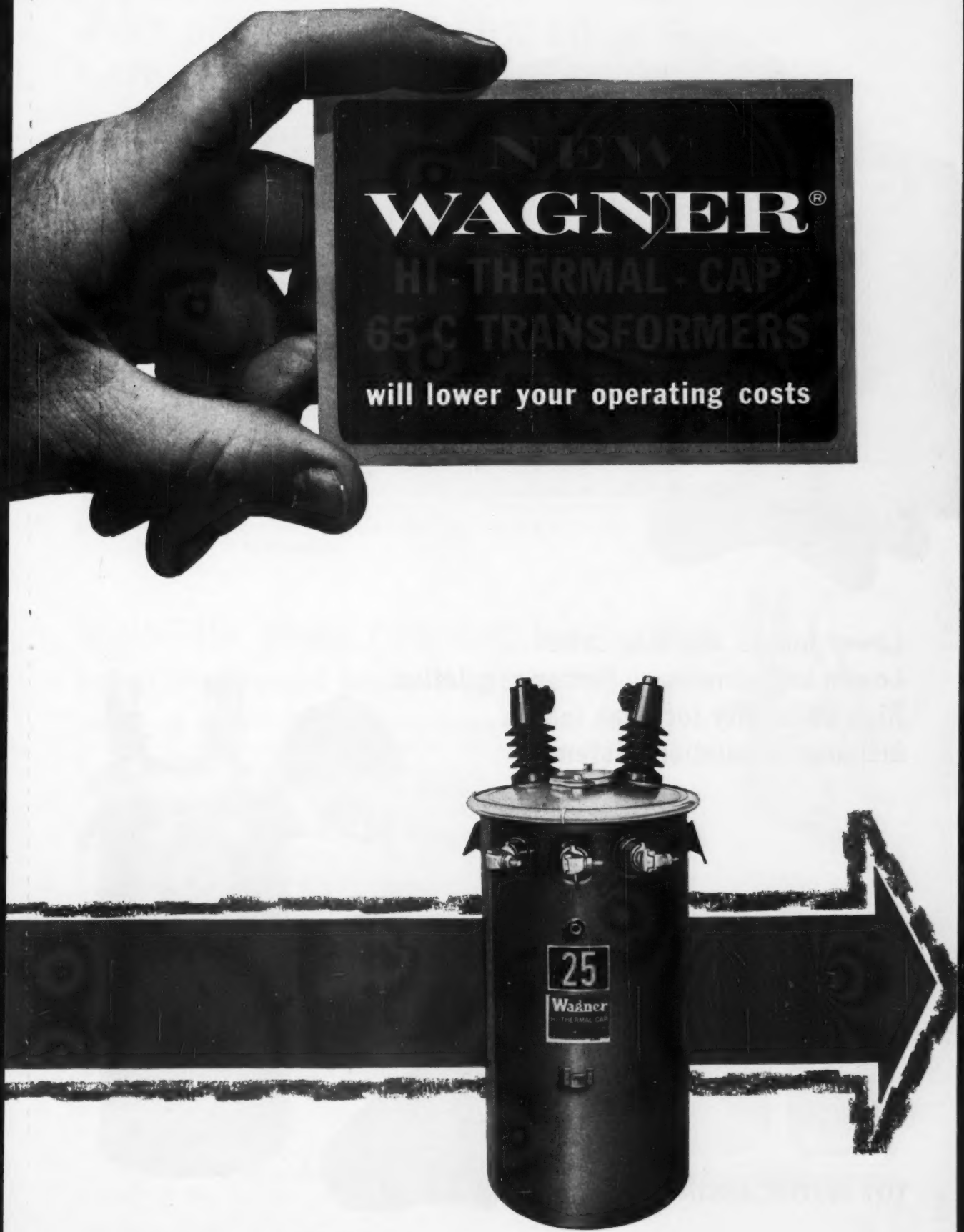
VERSATILE

REYNOLDS 5005

high strength, all-aluminum conductor

Reynolds 5005 aluminum alloy conductor is ideal for many overhead cable applications. It is excellent as the neutral messenger in triplex, provides low cost installations on distribution lines, and is adaptable for many high voltage lines. In addition, it is especially attractive for reconductoring, and can be used in special cable constructions. Reynolds 5005 is light in weight—stringing and handling costs are reduced. Since there is no steel core, splicing is easier, and there is no possibility of galvanic corrosion. Minimum guaranteed conductivity 53.5%. Complete data available from your nearest Reynolds branch office, Reynolds Electrical Distributor, or *Reynolds Metals Company, P.O. Box 2346-EL, Richmond 18, Virginia.*

Watch Reynolds exciting TV programs on NBC: The Dick Powell **Reynolds Aluminum Show** every other Tuesday; **Say When**, weekdays; **All Star Golf**—in living color—every Saturday.


WAGNER®
HI-THERMAL-CAP
65°C TRANSFORMERS
will lower your operating costs
25
Wagner
HI-THERMAL-CAP

Lower losses and loss ratios...
Lower impedances... Better regulation...
High capability for peak loads...
Insuldur® insulation systems

LIVE BETTER...*Electrically*

THEY OPERATE WITH LOW LOSSES

L_2FPL means lower losses for peak loads

This also means more economical operation at all loads. Core losses are low, copper losses have been reduced, resulting in lower total losses and lower ratios of approximately 2.5 to 1. This provides savings in cost of losses under normal loading conditions, and on overloads. Since the cost of losses greatly affects operating expense, the lower total losses add up to lower operating costs.

These new Wagner® Transformers will help you meet tomorrow's loads and their requirements reliably and economically.

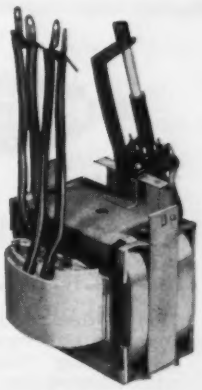
HANDLE PEAK LOADS WITH EASE

INSULDUR® Insulation System allows high thermal loading with 65°C rise transformers

The high thermal capabilities of Wagner HI-THERMAL-CAP 65°C Transformers result from the use of Insuldur layer insulation and high temperature epoxy coated conductors. The remarkable thermal-aging characteristics of Insuldur cuts insulation failure due to heat in half. Insulation retains full dielectric strength and binding qualities at 65°C operation.

MAINTAIN GOOD CUSTOMER VOLTAGE

Lower impedances improve voltage regulation

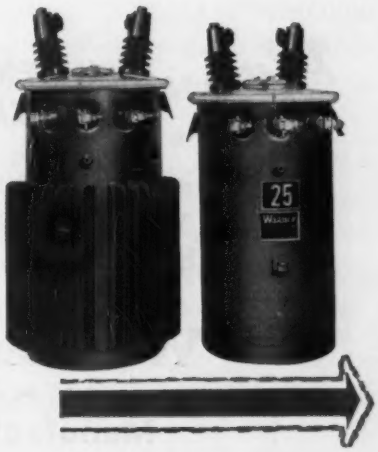


Impedances for ratings 100 Kva and below are 2% or less. You get minimum voltage drops even under high overloads—regulation problems are minimized.

Coils are wound with thermosetting resin on the layer insulation which bonds the coils together. The new endplate design gives positive bracing. This assures high short circuit strength of at least 40 times full-load current.

ARE SMALLER AND LIGHTER

Allow you to increase capacity without additional investment in new poles



The new Wagner HI-THERMAL-CAP 65°C, 25 Kva, 7200 volt Transformers are lighter and smaller—2½" shorter than their 55°C counterparts, yet use approximately the same amount of oil. They are easier to store and handle —take less space on poles. For example, a 55° 100 Kva transformer can be replaced with a 65° 167 Kva transformer.

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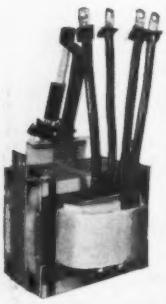

SIMPLIFIED ENDPLATE DESIGN

The new endplate assembly provides rigid construction for greater mechanical strength. Virtually all nuts, bolts, screws, individual coil clamp blocks, springs, thimbles, angle irons and brackets are eliminated. The assembly is smaller in size—lighter in weight.

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A porcelain-like coating gives improved corrosion resistance to covers, protects from line to ground, insulates small animals from the grounded cover to prevent outages. Coating is applied to covers, to the Shur-Seal clamping ring, and to cover bolts.

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WT61-18

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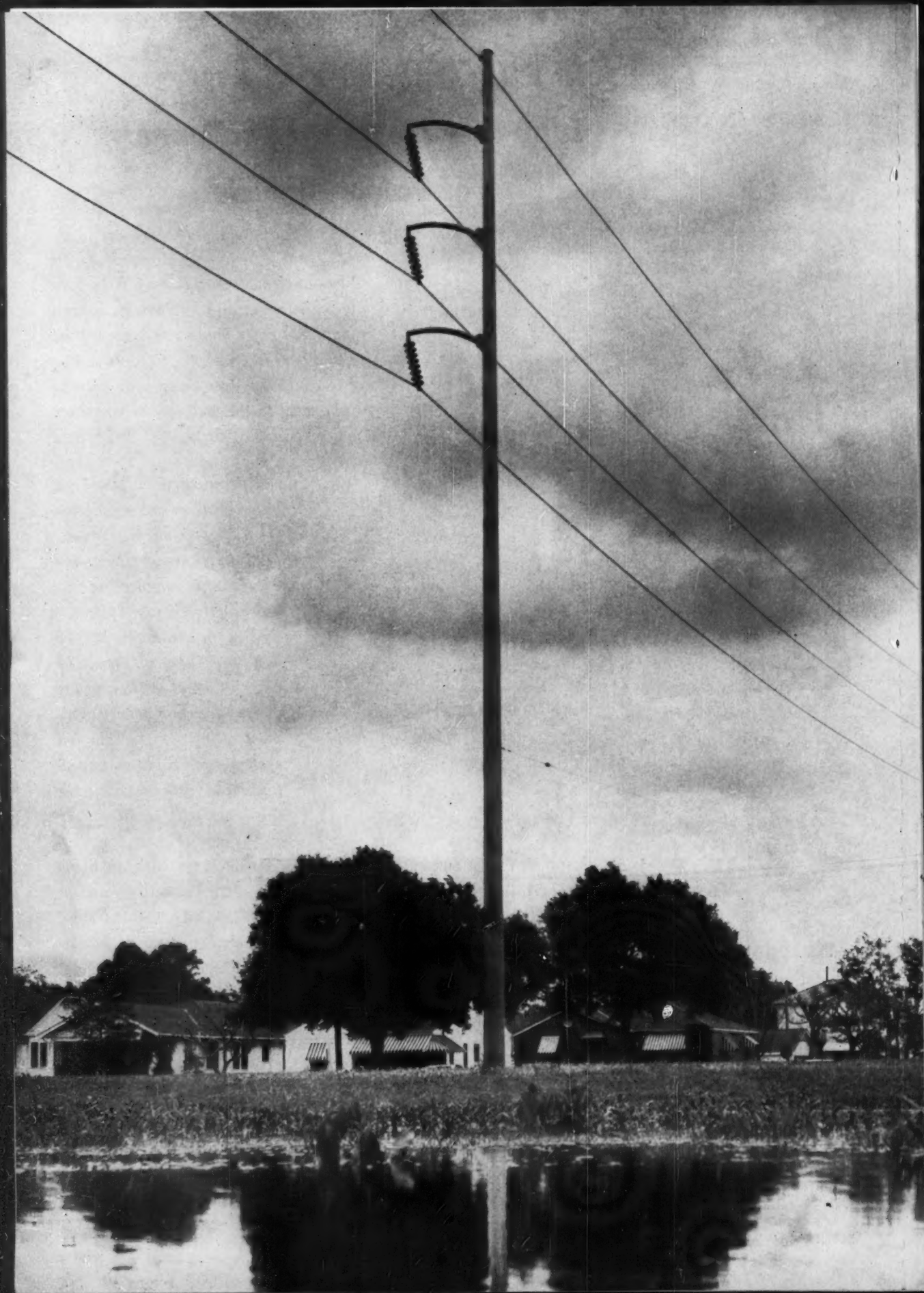
"We apparently have been buying suspension insulators for a long time which far exceed in their performance values the engineering requirements of our system—paying for characteristics we don't need, and can't use. The new Lapp **Hi-F** *suspension meets the requirements of almost all of our transmission system—and saves us important money. We're glad to see this break with tradition."*

Lapp ***Hi-F*** is a suspension insulator 9" in diameter with an M&E strength rating of 14,000 lbs. In all other mechanical ratings, and in all electrical characteristics, it matches the EEI-NEMA 52-3 15,000-lb. "standard 10-inch" unit. It is physically interchangeable with "standard" suspension insulators. Weighs one-third less, costs less to handle in the field, is easier to work with hot-line tools.

We hope you'll take a new look and a long look at your transmission line costs—and efficiency. We think you'll agree that Lapp ***Hi-F*** makes good sense from all viewpoints—purchasing, engineering, operating and construction.

Lapp Insulator Co., Inc., LeRoy, N. Y.

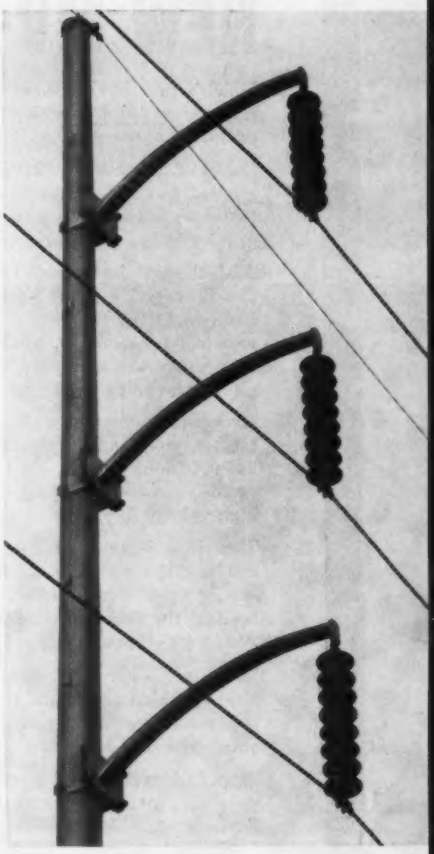


Unique 115 KV Steel Pole line solves beauty problem in New Orleans

New Orleans Public Service Inc. was faced with the problem of installing a new 115 KV transmission line through an attractive residential area. Property values were high, space was limited and appearance was an extremely important factor.

After investigating every possible type of construction, engineers reached the decision that galvanized steel poles with gracefully curved arms were the best solution. Steel was strong enough to carry the heavy loads—steel poles could be placed much farther apart—360 feet—and galvanized steel poles would blend aesthetically with their surroundings.

There are now 86 tapered round steel poles in this service. The poles were made from high-strength low-alloy steel by Union Metal of Canton, Ohio.



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Four USS Steels for towers and substations

ASTM A7 Structural Carbon Steel galvanized for long service life. Widely used for low cost and good appearance. Minimum yield point 33,000 psi.

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Holan's new MV-50 Elbow gives you 30% more working range than limited action* aerial arms using other types of bucket suspension.

Secret of the added working range is the offset yoke (patents applied for) and the bucket suspension design. The roomy two-man bucket pivots on the center line of the center of gravity inside the yoke.

Add the 85° lower arm/135° upper arm travel and continuous rotation to the yoke and suspension design and you have an Elbow that will lift workmen to a wide variety of working positions . . . reach over parked cars, over and between power and telephone lines, and up the property side of the pole.

Everything about the MV-50 is safe. Insulation of the bucket, yoke and upper arm is adequate for working up to 345,000 volts (A.C.). And it can be fitted with Holan's exclusive metal shielding kit for bare hand work on live high-voltage lines.

Two single buckets with patented Holan bucket positioners can be suspended from a straight upper arm. Or the MV-50 can be fitted with a winch in the superstructure, a sheave head at the end of the lower arm for "live booming" from 2000 to 6000 pounds.

Don't settle for less working range than you need in a limited action aerial lift. Call your Holan Field Representative today . . . or write us . . . for complete information about the MV-50.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio

**Less than 270° upper arm, 120° lower arm travel.*

Holan's MV-50, with its unique offset yoke, bucket suspension design and parallelogram mechanical bucket leveling system, lifts a lineman high on the property side of the pole for aerial work. The increased range assures a variety of working positions with minimum truck maneuvering. The new Holan Elbow reaches up 50 feet, out 30 feet on either side of the body.

Holan

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HOLAN

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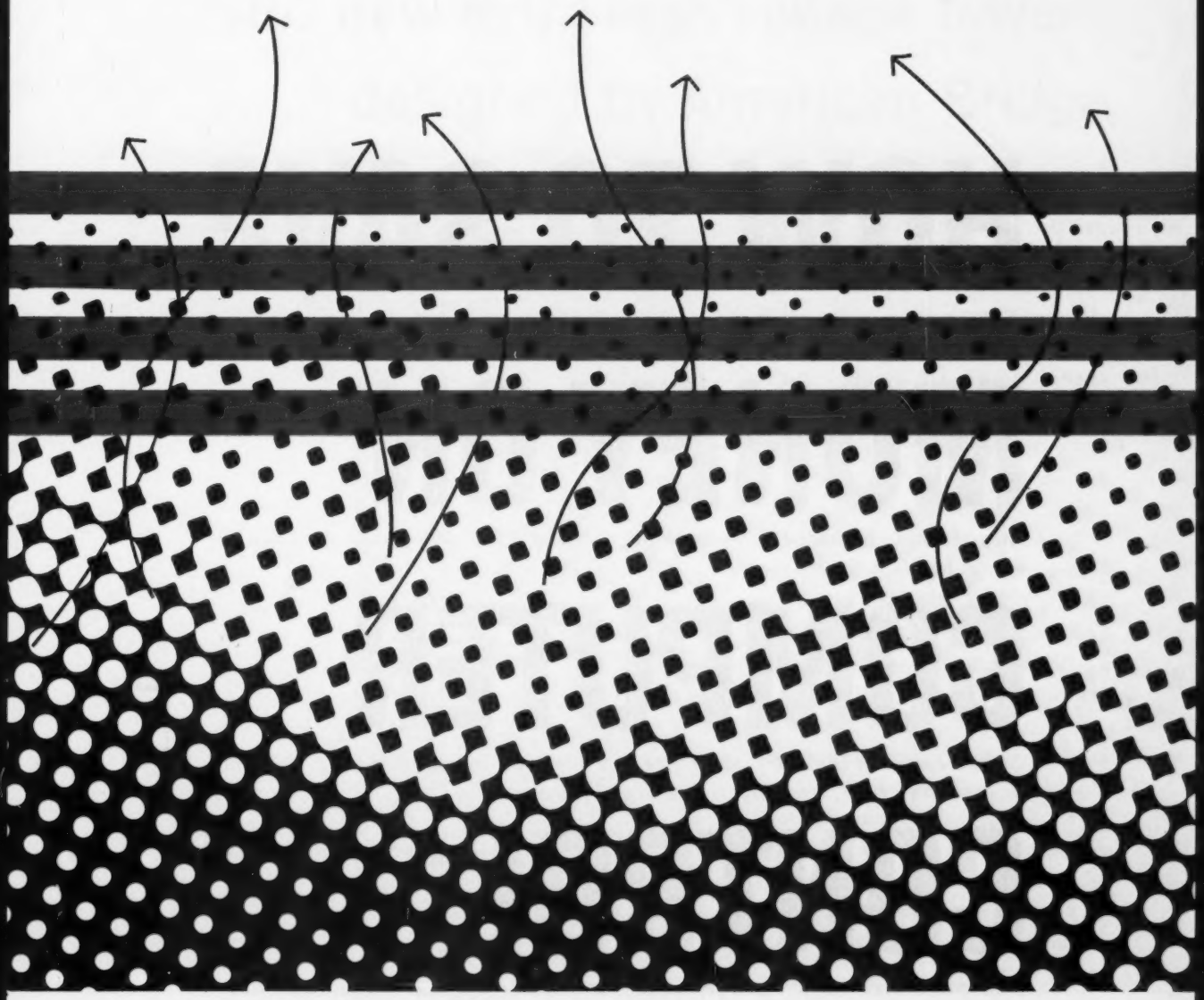

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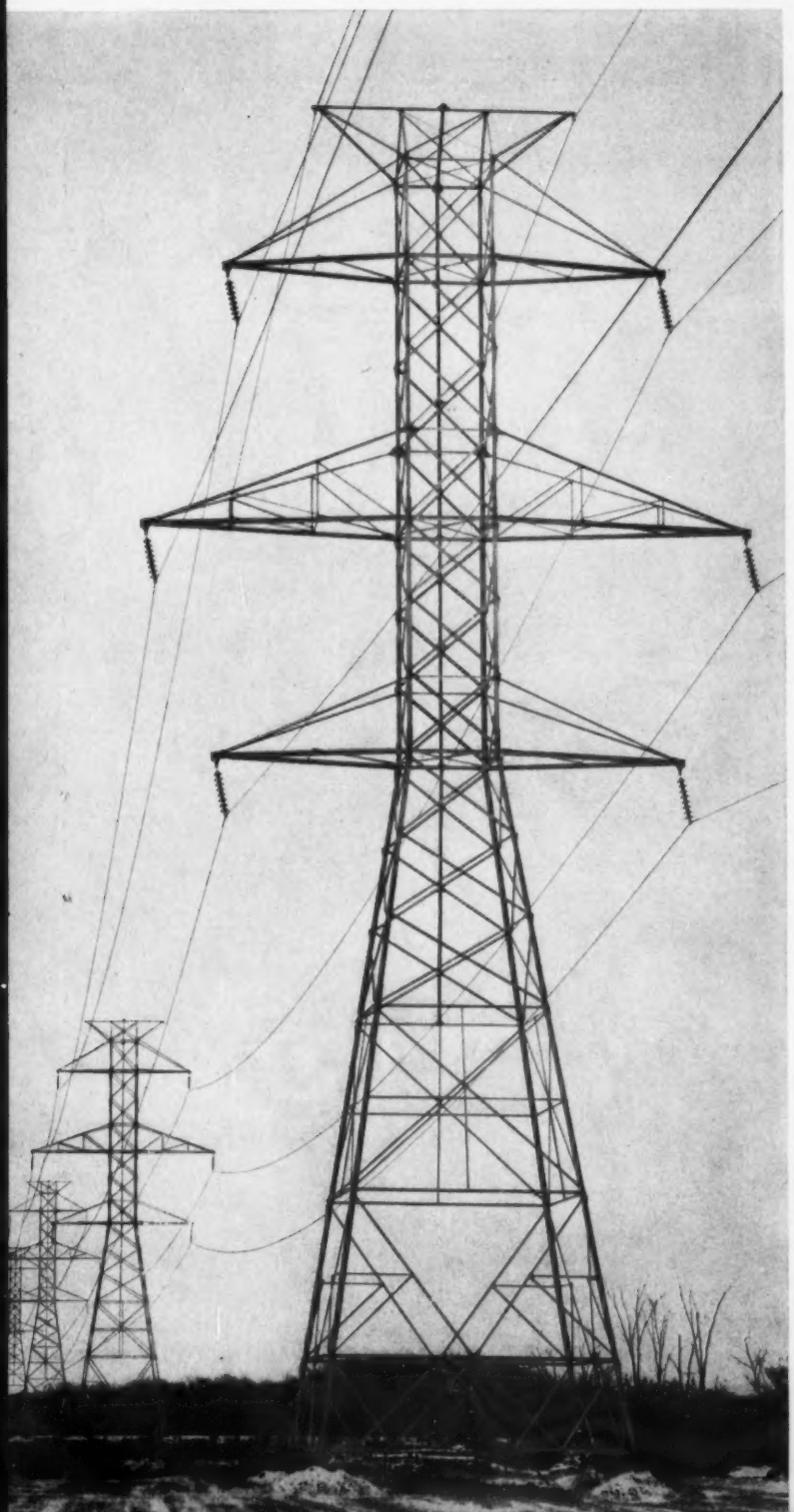
180 new extra high voltage towers designed by American Bridge



The Detroit Edison Company is continuing its program of constructing steel tower transmission lines that will ultimately form a part of an extra high voltage system. The latest step in this program required 180 new double circuit Extra High Voltage towers to be integrated into a grid system surrounding the city.

Tower design and fabrication was turned over to American Bridge, long the leading specialist in this field. The result was 180 towers with a total weight of only 1700 tons. By using both A-7 and USS MAN-TEN to the best advantage, sufficient weight was saved to hold average tower weight to less than 10 tons.

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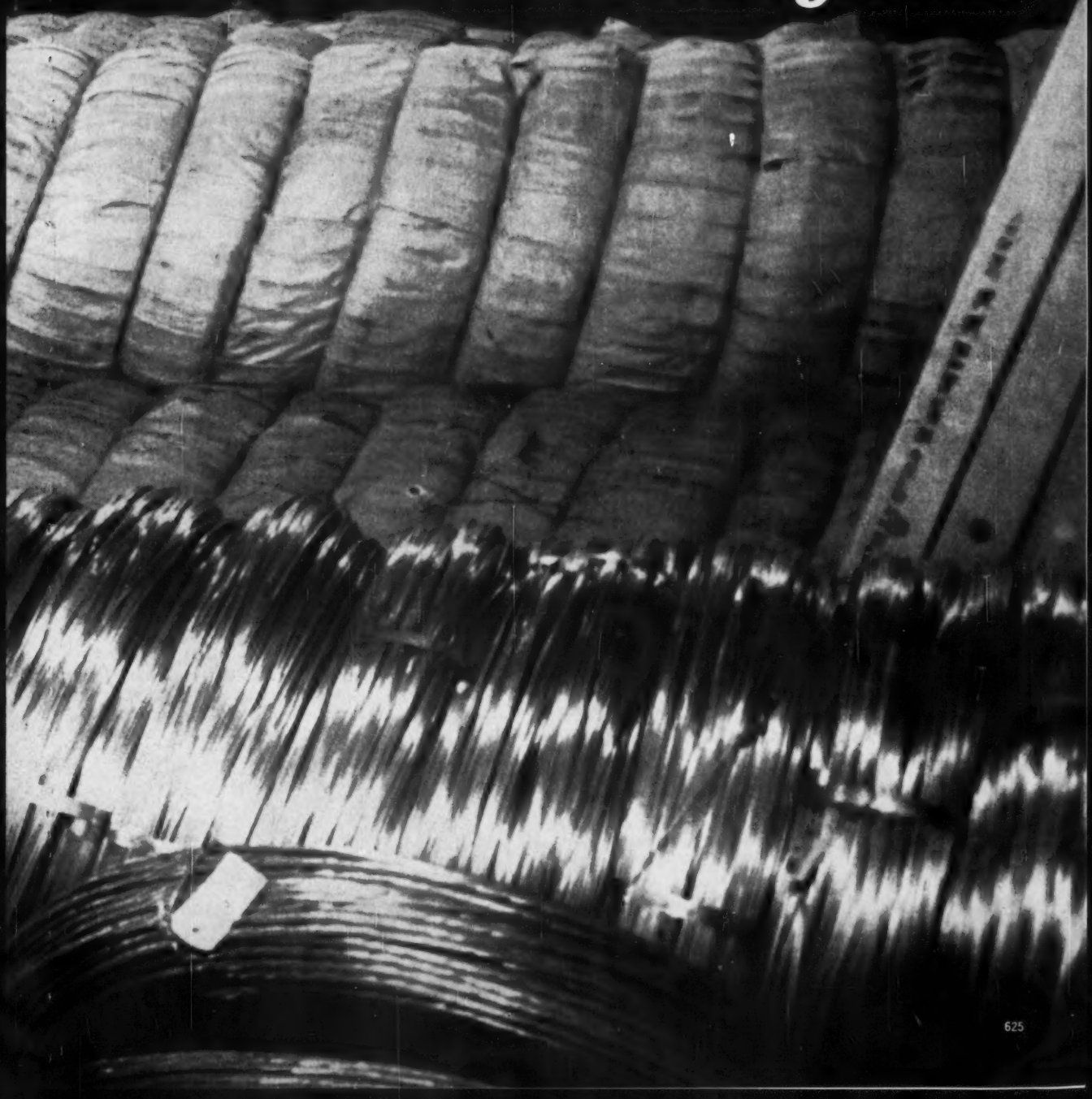

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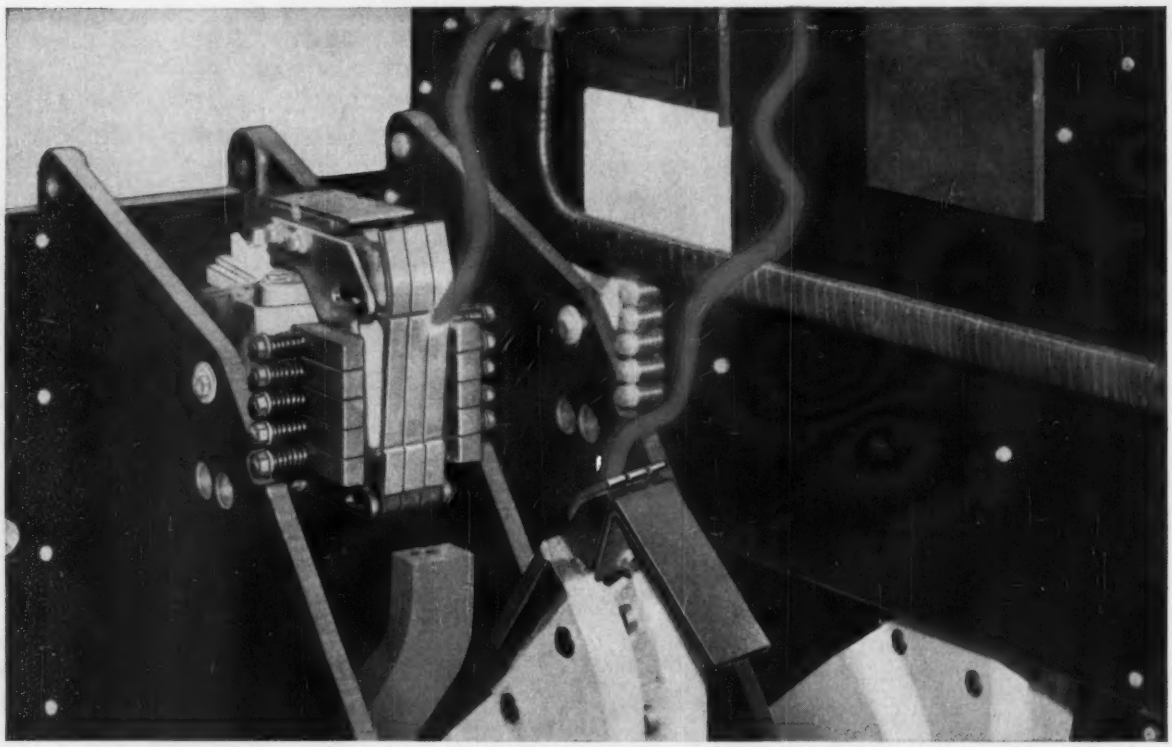

Full protection at 1 million kva

with this 15-kv maximum reliability metal-clad switchgear

New interrupting capability — 1,000,000 kva and below with *Ruptair* magnetic air circuit breaker in A-C 15-kv switchgear, means complete system and personnel safety.

Here are the *Full Protection* facts:

- Maximum reliability assured . . . insulation designed and tested to give utmost dielectric integrity.
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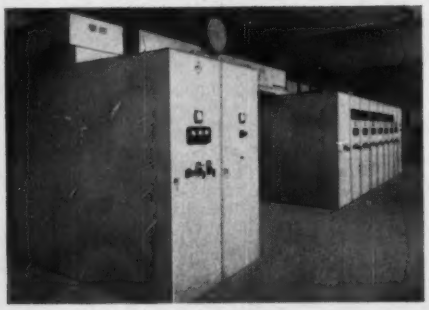
- Enclosed service aisleway provided in the outdoor *Shelter-Clad* switchgear.
- Entire front panel can be used for meters and relays. Both stored energy and solenoid operators are available in a complete line of 5 and 15-kv switchgear. Simply installed, easily maintained, this new 15-kv switchgear now serves utilities, refineries, steel plants, and institutions. For product details, call, wire or write your nearby A-C office. A-1523

Tilted front steel barrier locks with cubicle to protect operator.



15-kv indoor metal-clad switchgear installed in a western utility.

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Editorial Comment

DECEMBER 4, 1961

We Need to Examine Steam Station Fixed Charges!

In *Electrical World's* 12th Steam Station Cost Survey this fall and in its 1959 predecessor, we called specific attention to the wide fluctuations in the fixed cost component of busbar energy cost and in the percentage used to compute these charges. In the more recent survey the range of fixed charges among stations was 20 to 1 and the range of percentage used in computing them 7 to 1. By comparison the 4.5 to 1 range of production costs was small.

We remain of the opinion that today closer industry attention to fixed charges is needed. We believe that it can have fully as great an effect in reducing the cost of energy as continued pressure for operating economies. After all, the final cost of producing a kwhr is the ultimate measure of plant design, other factors being reasonably comparable.

We are therefore particularly in sympathy with the letter that appears in the Letters column on page 3 of this issue. In it the writer suggests that when the questionnaire for the 13th Steam Station Cost Survey of 1963 is prepared, it ask reporting stations to itemize components of the fixed charge percentage.

This is not an altogether new idea with us. We have considered such a course on a number of occasions but have been advised to refrain on the grounds that the exact components of this percentage are in the sacrosanct area of management prerogative. To seek precise and definitive data in this area could, and very well might, lead to rejection of the questionnaire and jeopardize the volume of returns. Even as matters stand, cost of energy data have often been withheld.

Nevertheless, we are convinced that publication of specific data on the components of the fixed charge percentage, on some comparable basis, is today highly desirable. It would certainly remove some of the ambiguity that surrounds the term, fixed charges, and would present a clear and unmistakable image of their contribution to the total cost of energy at the busbar.

Area Development Programs—Industry Unity Needed

A recent survey by an Edison Electric Institute committee reveals that electric utilities are becoming more and more interested in area-development programs. It also shows that there are many ideas about what constitutes a good program.

This is understandable. A service area is as personal as a pair of socks, and it figures that individual utilities are going to gear their activities to suit the needs of their areas. This has the unfortunate effect of slowing the rate of growth of a national electric utility area-development program. About the only across-the-board, unembarrassing common denominator usable by all utilities is the belief that planning and zoning are good and should be promoted. From this point on, area development goes off in all directions.

The word "unembarrassing" is used because it must be remembered that area development, particularly that part of it devoted to attracting new industries, places the utilities in the position of competing with each other.

It occurs to us, though, that there could and should be some means of idea exchanges—beyond a workshop once a year—by which the experience of some companies would be available to benefit others. These idea exchanges could deal with valuable, effective procedures without giving away prospect lists or other "classified" information to the competition.

Ideally, the net result would be to get unified electric utility participation in area development to advance even faster. If there is any doubt about the advisability of this, take a look at the new area development and redevelopment programs of the federal government, and the aggressive way the Rural Electrification Administration is pushing them.

FULTON

The Protagonists:

COLUMBIA RIVER POWER — both Canadian and American—is in jeopardy as the bitter struggle between Premier W. A. C. Bennett of British Columbia (right) and Canada's federal government in Ottawa continues. Bennett will only develop the Columbia on the basis of long-term sale of power to the US. Justice Minister Davie Fulton (left), chief federal spokesman, won't accede to Bennett's demands

BENNETT

Columbia Treaty Battle Continues

Fate of Northwest development uncertan as B. C. Premier and Canadian federal government exchange strong charges

British Columbia Premier W. A. C. Bennett's Indian wrestling with his federal government in Ottawa appears to be near a climax. Bennett has the leverage and is applying pressure for a settlement.

The key to the bitter dispute is whether the federal government will yield and grant a license for B. C. to market Columbia River power in the US on a long-term basis. If not, Bennett seems determined to go ahead with development of his Peace River project; through his expropriated B. C. Electric Co (EW, Aug. 14, p 64), and forego development of the Columbia.

Ottawa won't grant the license, and the crisis is deepening. Justice Minister Davie Fulton, Ottawa's chief spear-carrier and negotiator of the controversial treaty with the US, delivered a blistering speech in Prince George, B. C., Nov. 28, attacking Bennett's stand.

"The Americans haven't been offered such a windfall since the purchase of Manhattan Island," Fulton declared. "Of course the American government and other officials hope Ottawa will adopt Bennett's policy. Of course Bennett is using it as a squeeze play, but Canadian government policy is still made at Ottawa; not in Washington and Victoria as Bennett would like to see."

Premier Bennett refused immediate comment on the speech, but Victoria reaction came fast from Attorney General Robert Bonner, who termed the speech the biggest political blunder of Fulton's career. Bonner specifically denied Fulton's allegations that the British Columbia teams which helped negotiate the treaty had changed their plans at Bennett's urging. Bonner said that he, as a B. C. representative on the negotiating team, had personally insisted the clause permitting sale of power to the US be written into the treaty.

Bennett and Kennedy

Confirmations from Victoria and Washington that Bennett had met President Kennedy when the latter was in Seattle gave Bennett's prestige a boost. And Interior Secretary Udall added his support by a statement playing down Canadian objections that B. C. might not be able to recapture the exported power when necessary. He later backed off this position with the explanation that he meant to say it was nonsense to suggest the US would not live up to any contract it might make.

On cue, Bonneville Power Administrator Charles Luce said that the Pacific Northwest's power needs will double in the next ten years and the area will be hard pressed to meet them. But he hastened to add that the needs will be met if all federal, regional, and private construction proceeds as scheduled and Canada implements the treaty.

Fulton asked Livingston Merchant, US Ambassador to Canada, to clarify Udall's position. Fulton is obviously nettled at what he considers US pressure to make Ottawa accept Bennett's position stand, and in his Prince George speech, he lashed out at Udall: "Udall knows what our stand has been. Why this pressure play? Because he hopes for a decision that would be an enormous advantage to his country."

Fulton also asked for clarification on the Bennett-Kennedy talks and said that Merchant had advised him that the brief conversation between them "was of a social nature and that there was no discussion of specific Columbia River treaty problems or policies."

Treaty ratification is still Fulton's aim. "I am convinced that there has not been, in recent years, a more striking example of Canadian-American partnership than the Columbia River treaty," he told his Prince George audience. "After months of painstaking negotiations, Americans and Canadians agreed on a formula to develop a resource which we have

jointly held and which we would now mutually share."

"That is a sensible, practical and mutually profitable arrangement between two neighbors. To exchange it for a penny-wise and pound-foolish agreement under which this country would dispose of a great resource in its entirety would be sheer madness," he concluded.

The federal government in Ottawa feels that ultimately all of Canada's water power resources will be required for the development of the Dominion, and successive federal governments have followed a policy of refusing to permit power exports except in limited quantities and for limited periods. Ottawa feels that US utilities would require at least a 35-year commitment for power, much longer than it thinks is sensible.

Fulton's blast, indicating that Ottawa is not planning to deal with the situation on Bennett's terms, means the situation has hardened, perhaps beyond repair. It appears to leave it up to Bennett whether he will negotiate terms which will permit fulfillment of the treaty as it stands, or see the treaty lapse and the Columbia project abandoned.

But Fulton, as treaty architect, stands to see his handiwork destroyed with the lapse. And US utility men in the US Northwest are beginning to get edgy about forthcoming power shortages. So time may force a decision.

Diefenbaker and Kennedy

Other rumors indicate that Kennedy will soon meet Prime Minister Diefenbaker to apply previously withheld pressure to settle the treaty question. Unofficial reports from Ottawa hint of a split in the federal cabinet, with Bennett's plans gaining more support. And the Canadian Chamber of Commerce, in its annual brief to Diefenbaker, supports the export of Canadian power to the US, providing it is subject to the safeguards necessary to meet Canada's ultimate requirements.

Cabinet sources in Ottawa vigorously deny reports of the split in the federal group. Both Diefenbaker and Postmaster General Hamilton, the only federal ministers to visit British Columbia lately, maintain that Fulton speaks for a unified government.

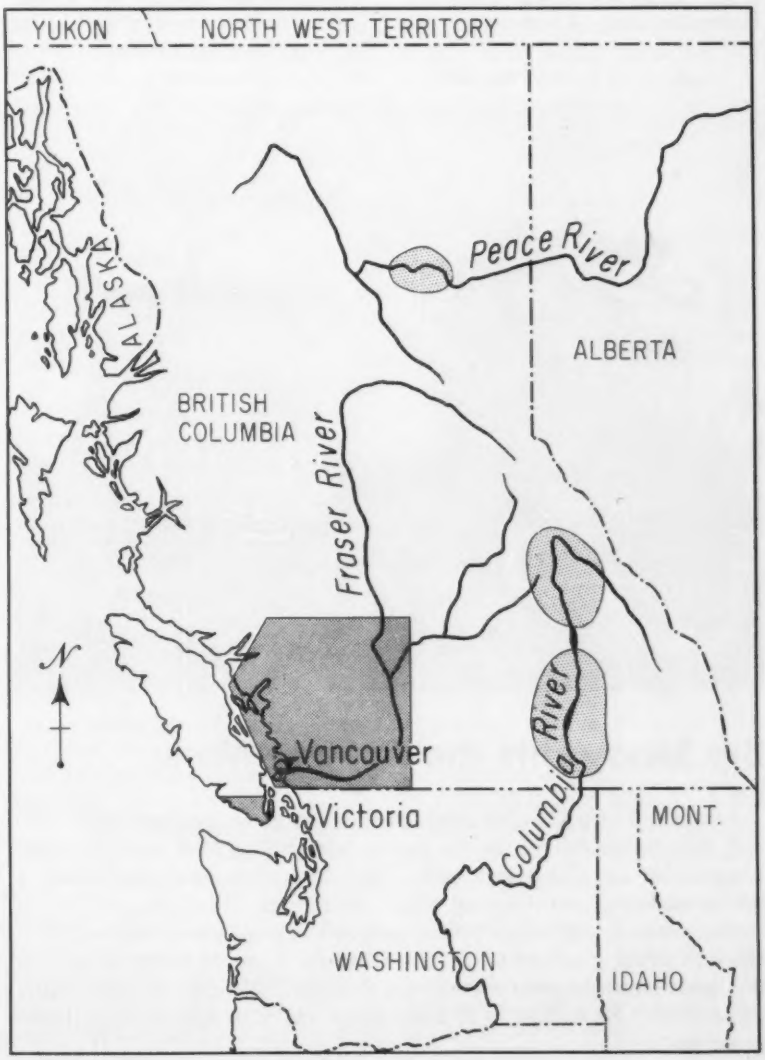
While Ottawa's predicament gets more uncomfortable, Bennett is consolidating his position by pushing ahead with Peace River development. This will, when complete, supply all of B. C.'s foreseeable power needs. The federal government can still block Bennett's Peace River scheme by refusing to grant him a license to develop it. The government has this power over navigable rivers, though the political value to the federal government of such a move is questionable.

Bennett's supreme confidence that he can sell all of the Columbia power downstream at 5 mills per kwhr leads observers to conclude that he already has some pretty firm commitments—perhaps obtained through a trip he took to California some time ago. He had provincial Lands and Forests Minister Ray Williston issue a challenge to Ottawa:

"If anybody wants to put British Columbia on the spot, all he has to say is that he doesn't agree with us, but if we can sell it at 5 mills let us go ahead and sell it."

And the Prizes:

HUGE HYDROELECTRIC RESOURCES in British Columbia are concentrated on Peace River (top of map) and upper Columbia. Latter is to be developed by Joint US-Canada treaty, as yet not ratified. Bennett controls the Peace River project plus the only Canadian market for power from either source



Holum Answers Critics Of Administration Policy

Assistant Interior Secretary calls for utility cooperation; says Administration doesn't want to socialize power

Cooperation between the government and investor-owned utilities will be needed to supply the nation's rapidly expanding power demand, according to Assistant Secretary of the Interior Kenneth Holum.

In an interview with the Associated Press, Holum replied to the charge that the Kennedy Administration is seeking to destroy private power utilities, and socialize energy production and distribution. There is no basis for such assertions, Holum insisted. To meet the nation's power needs, he said, "sustained heavy expansion by all power suppliers—public, cooperative, and private—is clearly needed. The role of the federal government in supplying an important segment of this power is now long established and must continue. We will meet our responsibilities in this field."

Holum termed unjustified a recent uproar over Upper Colorado River Storage Project power lines. He pointed out that the federal lines were recommended by the Eisenhower Administration as well as by the Kennedy Administration, and that the Interior Dept is negotiating with the investor-owned utilities in the area on how the power will be handled. Asked about claims that the government will duplicate private lines at the project, Holum replied that there would only be "duplication of lines the companies would like to construct, but have not."

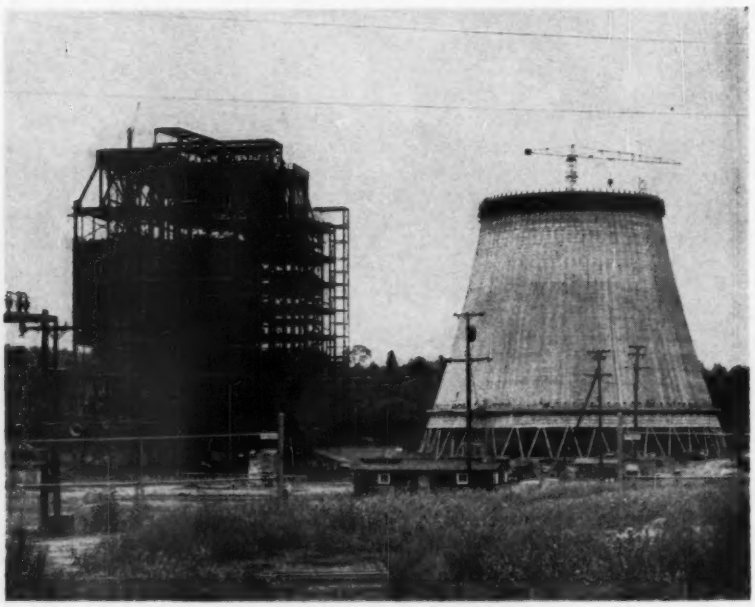
The Administration, said the Assistant Secretary, has no intention of opposing private projects involving power alone. But he said it would insist that multipurpose projects be built for maximum development of water and other resources in the public interest. Maximum resource development, under federal leadership, will stimulate economic production and help the investor-owned utilities as well as other groups in the country, he said.

During the interview, Holum also defended the record of the rural electric cooperatives and pointed to the advantages of linking federal power systems to form a giant grid.

A former REA cooperative official at Aberdeen, S. D., Holum said the cooperatives should be praised, not criticized. They repay money borrowed from the government with interest and supply electricity to rural areas which investor-owned utilities do not want to serve.

Asked to comment on editorial criticism over proposals to link several federal transmission systems, Holum said that Congress had made funds available for studies of the advisability of such a move. To be studied are links connecting federal projects in the Pacific Northwest, California, Upper Colorado River Projects, the Missouri River Basin, the Tennessee Valley Authority, and the Southeastern and Southwestern Power Administration areas.

Holum feels that such a link would provide flexibility of operation and permit the rapid movement of surplus or dump power to shortage areas, thus eliminating waste. Cooperation of investor-owned power firms is being asked in the studies, he said, and such a power grid would help the utilities more than hurt them. Holum said the Bonneville Power Administration has shown that federal and private producers can get along when linked together in a grid.



Big Sandy Hits the Midway Mark

Kentucky Power Co's Big Sandy plant is just about half completed. The 265-Mw station will be on the line in late 1962. Steel work is nearly complete on the 150-ft high boiler, and the hyperbolic cooling tower is taking shape.

The tower, first of its kind to be used in this hemisphere, will be 320 ft tall with a base diameter of 245 ft. Diameter tapers to 140 ft at the top. Big Sandy's turbine-generator will use steam at 2,400 psi, 1,050F. Boiler will furnish 1.89 million lb of main steam and 1.54 million lb of reheat steam per hour.

Ease Financing Formula For Dams, Morton Asks

THRUSTON MORTON
Wants more liberal formula

Former Republican National Chairman Sen Thruston Morton (R-Ky.) has asked for a more liberal federal formula for financing dam construction.

Addressing a meeting of Kentucky rural electric cooperatives, Morton called for a change in the present justification formula under which "we can't build a dam unless the benefits in three fixed fields (flood control, irrigation, and navigation) can be made to exceed the costs." This justification formula holds back river development, Morton said, and "river development is one of the keystones of an area redevelopment program."

Robert Partridge, legislative representative of the National Assn of Rural Electric Cooperatives, and John Whisman, a special assistant to Kentucky Governor Bert Combs, echoed Morton's remarks.

Partridge said that the Kennedy Administration, since Congress adjourned, has given orders for a revision of the Eisenhower Administration's Budget Bureau Circular A-47. He said this regulation, by the former Budget Bureau heads, was intended to make it more difficult to obtain federal funds to develop rivers.

"The executive branch, however, must have the backing of the Congress in liberalizing the old formulas," Partridge said. "For your rivers in the hills of Kentucky to be developed will require passage of the Trimble Bill or something very much like it."

Whisman told the meeting: "Our big roadblock to water resource development in east Kentucky is the succession of narrow little rivers lacking in the reservoirs that can qualify most easily under existing schemes for federal financing."

Rival Co-ops May File Joint Application

Two Missouri Basin Cooperatives, rivals for a Rural Electrification Administration G & T loan, may be getting together.

The co-ops, Lignite Electric Power Cooperative Inc, and Basin Electric Power Cooperative, had each made application for a loan to build a 200-Mw generating plant on the same site, near Stanton, N. D. (EW, Nov. 20, 1961 p 50). But REA Administrator Norman Clapp, by sending identical letters to the two co-ops, has hinted that it might be well if they got together on a joint application.

Clapp's comments were written to President Arthur Jones of the Basin Electric Power Co-op and President Luverne Splickan of Lignite. He said the comments were based on studies "prompted by the applications filed with us for loans to build additional generating capacity in that region."

In welcoming such an application, Clapp laid out a series of requirements "which we feel must be met, over and above the usual legal and feasibility requirements, if we are to secure the maximum benefits . . ." These added requirements, Clapp pointed out, should serve as the basis "for a reappraisal of the loan applications already submitted and possibly a new or amended application which will have the unified support of the rural electric groups in that entire region . . ."

Here are the requirements laid out by Clapp:

- "Additional generating capacity to be financed by REA loan funds . . . must be justified, in the light of the known and anticipated magnitude of the power needs of the rural electric systems, by the full initial allocation of this additional capacity to supply their needs over and above their existing power resources."
- "The transmission system of the US Bureau of Reclamation, in its eastern marketing area, possesses unused capacity which can accommodate an additional 200 Mw of generated power fed in near Garrison Dam and distributed throughout the system. REA feels this unused transmission capacity of a federal agency should be utilized in any plan developed in this region, assuming satisfactory arrangements can be made with the Department of the Interior. REA will not approve a loan for . . . building new transmission facilities where the Bureau's system can be used . . ."
- "Any arrangement for transmission of additional REA financed power supply from the Garrison Dam vicinity must include an understanding that reasonable quantities of the additional generating capacity, not required by rural electric systems within the Bureau's marketing area, can be made available for delivery to bordering rural electric systems beyond the Bureau's transmission system."
- "Ownership of new generating capacity of the size here contemplated should be vested in a cooperative organization of the cooperative systems taking power from these facilities. The control of such large-scale generating capacity to be financed by REA funds should rest with the cooperative systems that need and use the power . . ."

Details and Tests of NEAR System

Signal generators and receivers for proposed 240-cps warning system are evaluated. Four other schemes are revealed

All utility systems in the country will be asked by Office of Civil Defense, Department of Defense, to (a) purchase, install, and maintain signal generating equipment for the National Emergency Alarm Repeater warning system; and (b) purchase, distribute to customers, and maintain receiving devices for the so-called NEAR system. To put the NEAR system in operation "within the next year," OCD has made the above proposal to utilities in California, Georgia, and Wisconsin (EW, Nov. 27, p 26) and will approach others in an eastern state.

On the basis of the 1960 public test at Charlotte, Mich., plus numerous other tests before and since, Consumers Power concludes there are no detrimental effects to its equipment or customers' equipment as a result of the NEAR signal. However, the company foresees a number of financial, legal and operational problems which must be resolved before the NEAR system is expanded. These questions involve liability, investment for and maintenance of signal generators and protective equipment, as well as procurement, distribution, maintenance and replacement of receivers.

So that utilities may study possible technical problems of the NEAR system and come to grips with its legal and financial aspects, OCD has released a report: *Field Installation and Evaluation, NEAR, Oct.* 1, 1957 - *Dec.* 31, 1959, compiled by Midwest Research Institute, Kansas City, Mo. Much of the data below is taken from this report.

What Is NEAR?

The proposed system will use electric utility lines to carry a 240-cps signal from generating units at power plants and substations to alarm-producing receivers plugged into convenience outlets on customers' premises. Sending a signal throughout the country from a master station under the control of the Defense Department implies a network of signal repeaters.

A *key* signal generator in a given area will send a coded signal over utility lines and interconnections to the adjacent ring of signal generators, which will repeat this to actuate the next adjacent ring. According to OCD, the coded signal can jump from 50 to 100 miles in its repeat action. Thus, starting from about 14 *key* signal generators, the coded warning signal can blanket the whole country through the activation of signal-generating stations at strategic locations.

Following receipt of the signal, all signal generators will produce a "necessarily continuous signal" of several minutes duration to activate receiving devices within their respective areas. This buzzer alarm will alert the population on a national or local basis to take action.

Under the proposed plan some 400 to 600 signal generators will cover the 130 electric utilities that comprise the country's major power pools. About 540 utilities, mostly municipal systems, are not interconnected. These can receive the signal either from a repeater line connection to the nearest source or by electrical connection to a neighboring grid. Thus, upwards of 1,100 signal generators may be required to cover the 96% of the population receiving central station service.

Why Use Utility Lines?

As proposed to the Georgia and Wisconsin utilities, OCD will provide for the interconnection of the *key* signal generators to national attack warning systems now operating over telephone facilities. Present thinking of OCD is to provide one receiver per customer of the 58 million utility customers in the country. Customers such as large office buildings, hotels, schools, industrial plants, etc, would either obtain additional receivers on a separate basis or could use internal communications facilities to spread the alarm received by one unit.

Recent civil defense studies show that casualties can be cut 50% when the public, warned far enough in advance, takes proper steps to survive. Some warning is needed to alert as many people as possible in the shortest time and at any time.

Present siren systems are most useful in heavily populated areas for warning people out of doors. Only a few sirens have been set up in suburban areas; none in rural areas. Investigation of the use of telephone facilities revealed that the cost of implementing the scheme would be prohibitive, and fewer people have telephone service.

Similarly, while millions of radio sets are installed, few are in use at a given moment. Means of turning them on automatically have been proposed, but radio has still another disadvantage, its susceptibility to jamming, or false signals which could render it untrustworthy.

Research through prototype operation of a power network warning system indicates that a frequency between 210 and 250 cps gives the greatest signal distribution. According to OCD, a 240-cps NEAR system is compatible with the usual operation of a power system. It does not imperil service continuity, produce abnormal operating conditions, or interfere with company or customer equipment operation. Furthermore, it requires little maintenance and does not demand high stand-by power.

How Signal Is Generated

Coded and alarm-activating signals will be generated by either series or shunt signal generators or inductors with their primaries connected to utility lines, generally at substations. The generators are three single-phase transformers with the primaries connected in delta, or grounded or ungrounded wye. Secondary windings are broken delta with a dc supply across the delta.

The secondary current produces a unidirectional mmf and provides the asymmetrical bias for the production of even harmonics of the fundamental 60-cps supply. Voltages of the fundamental frequency and all harmonics not divisible by three will balance, i.e., add to zero, around the secondary delta.

With inductor primaries in delta, there will be very little third har-

Released in OCD Final Report

monic voltage across the delta secondary. Also, there is minimum exposure to damage of the excitation dc-supply equipment from system faults. Standby magnetizing currrent is typical of standard power transformer banks.

Inductor Is Reactive Load

During signaling a much larger magnetizing current is induced because of the excitation flux bias on the core. The inductor load presents reactive load to the utility systems; the current wave form is asymmetrical because of the even harmonics. Single-phase cores provide the necessary flux-path return for the flux bias. A five-legged core can be designed.

Signal-inductor efficiency increases in direct ratio to the flux density in the core. Generators used in field tests, operated up to 30% higher than normal flux density, make necessary a core design with minimum leakage. Wound-core design has proven satisfactory.

Signals from more than one inductor on a power network will add. The fourth harmonic signal is generated at the same phase position with relation to the 60-cps voltage. It is necessary, however, to bias all inductors with a common polarity.

Primary of a series inductor would be inserted into an outgoing line from a substation or between a turbogenerator and the switchyard bus. In a typical installation, the 240-cps signal voltage will be 1 to 2% of the 60-cps voltage.

At single-phase substation transformers for turbine-generators where the three single-phase neutral leads are brought out, one side of the series winding may be connected to the neutral. A "neutral" connection may be made only as a matter of convenience, because safety requires that the series winding of a signal generator be insulated from its excitation winding and case at full phase voltage. The area of signal coverage per NEAR generator will be much greater for installations at power stations, but attenuation will be 50 to 70% compared with 10 to 20% at substations.

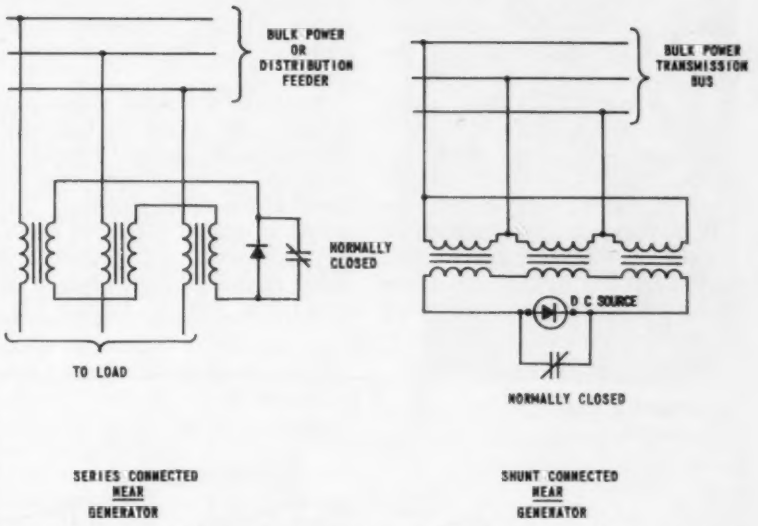
Although conventional transformers can be used as series inductors, it is recommended by OCD that special units, which cost little more than conventional units, be used.

During standby, the excitation winding of the series inductor is shorted through the signaling switch, with a load current proportional to the turns ratio flowing in the excitation winding. With some modifications of signal generator design, especially for neutral installations, it is expedient to short the series winding with the signaling switch.

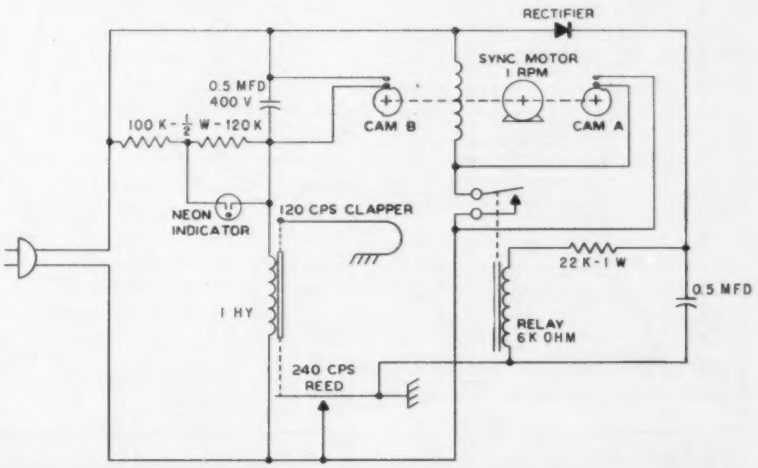
Current flowing in the secondary when the signaling switch is open produces a high voltage in each of the three phases of the signal generator. The rectifier (in a self-excited unit) must withstand this transient voltage unless protective equipment is added.

Shunt signal inductors may have their primaries connected to the power system at any voltage in the same manner as power transformers.

For the 1960 test, Consumers Power told *Electrical World* that both shunt signal generators were



TWO TYPES OF SIGNAL GENERATORS may be used on utility lines. Series unit is for local area coverage, shunt unit would form the basic national system

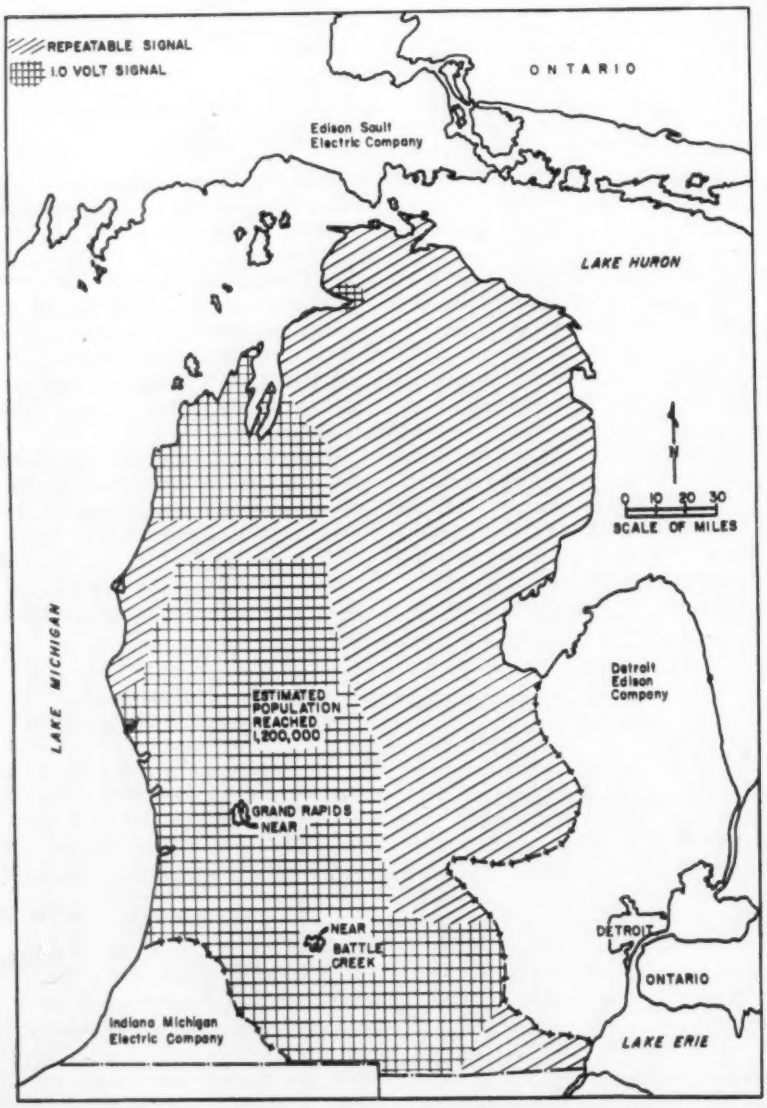


HOME RECEIVER is designed to detect a 1-v 240-cps signal sustained for 10 sec or more while on standby, then sound an alarm for 50 sec and reset

connected to 46-kv buses in transmission substations. The only changes required were those to deenergize the signal generators under normal operation and fault conditions. At Grand Rapids, fuses were used for fault protection. An OCB was used at Battle Creek.

The primary of the shunt generator connected in delta offers several advantages: almost no third harmonic appears across the broken delta secondary, and the rectifier voltage rating may be minimized; when a line-to-ground fault occurs, no unusual voltage appears across the broken delta; signaling efficiency is slightly higher; and power utilities frequently prefer that no ground path be added to the system. With the secondary broken delta kept normally closed by a shorting switch during standby, exposure to line transients and line fault voltages is minimized.

To minimize standby magnetizing current, noise, losses and high magnetizing inrush current, a series reactor may be introduced in the line ahead of the shunt generator. This reactor is shorted out during signaling operations. The generator at Grand Rapids substation was so designed (EW, Oct. 31, 1960, p 50).



OPERATING AREA of shunt signal generators in Battle Creek and Grand Rapids covered about 14,000 sq miles. A 240-cps signal strong enough to actuate repeater receivers was transmitted throughout most of lower Michigan

Shunt signal generators can be self-excited with the primary connected in ungrounded wye. Almost no self-excitation, however, occurs at flux levels ordinarily used in transformer cores. At flux levels up to about 23,000 to 26,000 gauss, self-excitation gives good signaling.

How Signal Is Received

The NEAR receiver will sense a 240-cps signal superimposed on the power line and, after a short delay, will cause an audible alarm for a specified time. In the absence of a further signal, it will return to standby, or "ready" condition.

Electrical and mechanical features of the receiver used in the October, 1960 test at Charlotte, Mich., are shown in the diagram. But OCD encourages manufacturers to submit designs with a view to obtaining less complex and more reliable receivers at lower cost.

Of about 30 manufacturers interested in producing the receiver, AC Spark Plug Div, General Motors, which made 2,000 for the Charlotte test, reportedly has eliminated the synchronous motor and vibrating reed from its latest model and now uses solid state devices. OCD adds that it has good indications that the cost will be under $10.

Performance requirements reissued last September by OCD include these minimum requirements for the non-coded NEAR receiver:

1. The receiver will operate with 240 ± 1 cps signal at a minimum of 1.0 v. Combined selectivity shall be such as to reject other frequencies on the power network. The receiver shall reject 130 v rms, 60 cps; 10 v rms, 180 cps; 10 v rms, 300 cps.

2. The receiver shall operate reliably within a 1-to-6-v-rms range of signal frequency, regardless of both the polarity of the ac line connection and the mounting position of the receiver. On signal levels up to 6 v, 240 cps, the receiver shall not detune, overload, or prevent proper operation. It shall not operate on a signal of 0.5 v rms or less, sustained for 10 min or longer.

3. After the 240-cps signal has been received for at least 11 sec or a maximum of 15 sec, the alarm will start and continue for 40 to 60 sec. A time delay shall return the receiver within 2 sec to its original condition for signal durations of less than 11 sec. The receiver shall not

integrate special 240-cps coding pulses to cause false operation. Transient voltage peaks, dips, or outages shall not cause false alarms.

4. The alarm receiver shall use a minimum of power at 115 v, 60 cps when on standby.

5. Electrical interference, conducted into the power line from an alarm receiver, shall not interfere with proper operation of other receivers on the same circuit. Electromagnetic and electrostatic radiation during standby shall not create objectionable interference.

6. The receiver shall be designed for an operating life of 5,000 complete cycles or five years, whichever occurs first. Only normal maintenance should be necessary.

Not all utility customers will be able to simply plug the receiver into a convenience outlet. Electrical equipment in some industrial plants generates a considerable level of 240-cps voltage. For these and possibly other customers, it will be necessary to bring the 240-cps signal in from the nearest point unaffected by the ambient 240-cps voltage. Tests show that the high side of the transformer serving such a customer is a possible signal source.

How the Signal Is Repeated

Upon the decision that an alert is to be called, a signal will be received by the key signal generators. These will send a coded 240-cps pulse to other signal generators which, in turn, will send pulses to the next ring of generators. Repeater receivers for this service must operate on 240-cps signals as low as 0.3 v and have a sensitivity capability to 0.2 v. Cost and size of these repeater receivers are not limiting factors, according to OCD; reliability and sensitivity are more important.

Repeater receivers at Elm Street and Four Mile substations of Consumers Power had two stages of electrical filtering and a magnetic amplifier. They proved to be reliable, but a transistorized version was not reliable enough under field testing.

How to Analyze Systems

For series generation, signal transmission distances are not great and signal distribution can be predicted by calculations or simple simulation.

For shunt signal generators, system analysis must be in greater detail:

1. It should provide signal voltage readings at each substation or circuit and show areas difficult to cover. Readings must include conditions from lightest to heaviest load. The area of adequate signal coverage is that in which 1.0 v or greater signal is present under the most adverse condition. Repeatable signal coverage is the area with 0.3 v or greater signal.

2. The signal generator should be as far as possible, electrically, from major generating stations. Signal generators should be reasonably close to circuits having unusually high signal attenuation. Several relatively small signal generators may give better signal coverage as well as lower cost.

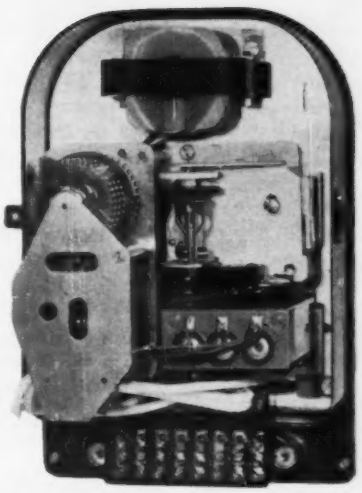
3. Signal generator size is determined by the minimum signal acceptable at the system conditions producing greatest signal attenuation, plus allowances for unusual system connections and growth.

4. Abnormal system conditions, line outages, capacitor switching, and operation of various combinations of generating plants can be simulated. Selection of signal generator sites should take into account minimum disruption of signal distribution with some circuits out.

Ac network analyzers may determine the current flow and voltage distribution of 240-cps signals. The conversion of some 60-cps parameters to 240 cps is simple. Power transformer and regulator reactances are multiplied by four. Resistances are left the same. Generators and synchronous condensers appear as loads equal to their transient reactances multiplied by four.

While series motors are essentially unchanged, induction motors, loaded or not, appear about as their locked rotor impedance multiplied by four. To approximate substation impedance, the percent motor load, the resistance load, and the secondary capacitor corrections have to be estimated for the three types of substation loading: residential, industrial, and residential with industrial. Extensive measurements made from field tests show that this system of analysis is sufficiently accurate to predict signal voltages and signal power requirements.

One series generator installation has been made in Kansas City; three



PROTOTYPE DECODER can respond to 40 different 240-cps signals to control utility equipment or activate alarms

were made on Consumers Power substations in Battle Creek. Small shunt generators were installed at Midwest Research Institute and at a small substation in Battle Creek.

A large shunt generator was installed temporarily using standard transformers to study signal distribution over a larger area. Later, two large shunt signal generators were installed on a semi-permanent basis: one at Elm Street substation in Battle Creek; the other at Four Mile substation in Grand Rapids.

Seven-day continuous charts of signal voltages were made for most circuits in Battle Creek. These measurements were made by a mobile laboratory equipped with a panoramic harmonic analyzer, voltmeters, chart recorders with filters tuned at 120, 180, 240, and 300 cps, an oscilloscope, and other gear.

A 1-v or greater signal was obtained throughout Battle Creek and a surrounding area of about 1,000 sq miles. The Grand Rapids generator extended the signal coverage to about 14,000 sq miles. A signal voltage sufficient to actuate a repeater was transmitted throughout most of lower Michigan. A group of 100 receivers were thoroughly field tested. No false alarms which could be attributed to 240-cps "noise" were recorded.

Assuming that a NEAR warning system is operational on utility lines, OCD contemplates this procedure for periodic testing. Special receiv-

ers, operating on a distinct code, would be at attended locations on a utility system. The coded pulse would be sent to determine the availability of a satisfactory signal. Pulses of 4 to 5 sec are being generated periodically in Michigan.

All receivers would be tested annually during national test alerts. OCD plans to embark on a special program of educating the public as to what to do when a NEAR alarm is received. It is OCD's opinion that the utility customer would be responsible for knowing whether his receiver worked properly.

Can Handle Other Functions

The Defense Department has stated that it will have no objection to the use of NEAR signal generators for basic utility load control and equipment switching as long as these do not interfere with the public warning. It also suggests that the system might be used to alert utility and non-utility personnel, such as civil defense workers, doctors, police, and volunteer fire departments, disaster-relief crews, and armed forces personnel, for emergency duty.

Prototype equipment, to encode and decode signaling frequency during the Charlotte test is as effective for general switching of remote utility equipment, according to James H. Patton, Sangamo Electric Co. Using different codes, up to 40 different functions can be controlled remotely from a central point without interference.

Equipment demonstrated by Sangamo consists of an encoder and a decoding receiver that can be set to respond to any of 40 different signals. Signals consist of an initiating pulse to pick up all receiver relays, followed by a second pulse to operate all receivers set for a particular function. Selection among functions is determined by time interval between initiation of one and the next operational pulse.

The Pulsadis receiver used in the test was developed by Compagnie des Compteurs, Montrouge, France, in cooperation with Sangamo. It has been used extensively in centralized telecontrol systems in European countries.

Since the successful tests made a year ago, Sangamo has done no further developing of prototypes. Sangamo does not think it possible, even with a mass market, to produce a reliable and rugged device providing multifunction coded responses in the $10 to $20 range.

Other Approaches

OCD reports it is going ahead with the 240-cps NEAR system on the basis of six years of research. Other possible systems, some revealed just recently, include:

National Emergency Warning System: The NEWS system currently is under test by Magnetic Controls Co, Minneapolis, Minn.

It requires the transmission of an audio frequency pulse-modulated signal over utility lines. Transmitters in each substation would be connected to the main substation bus through special transformers. The NEWS transmitters have pulse power capabilities of 2 kw, but are conservatively used at 1 kw pulse power. They are keyed with a 3-phase driver so that one pulse consisting of three to six cycles of the modulation frequency is transmitted for every cycle of line frequency. The signal transmitted simultaneously on all substation feeders would be detected in the home by a simple frequency-sensitive, pulse-integrating receiver. With pulse integration this system can transmit digital codes to load control receivers, capacitor switching receivers, etc., with a separate frequency for warning receivers. This could be a national emergency frequency designated by the government. Transmitters in each substation may be connected back to a control point by telephone lines for simultaneous, single, or group control.

Due to the frequency and the specific method of transmission, distribution transformers need not be bypassed to insure signal reception at homes. Magnetic Controls states that the frequency range is such that the impedance seen by the signal transmitter is relatively constant over a wide range of system load. Where line short-circuit reactors and power-factor capacitors are used, some signal attenuation may occur. But standard equipment can minimize this effect.

"Compactron" Alarm-Radio: A radio set that sounds an initial alarm and automatically tunes to a preset but adjustable radio broadcasting frequency, has been demonstrated by General Electric Co.

Designed to work with the proposed NEAR system, the Compactron receiver would plug into a convenience outlet and pick up the 240-cps signal over utility lines.

Using a system of reed switches, the radio sets off a load buzzer. This alarm stops as soon as the radio begins to broadcast instructions. The alarm-radio will operate whether or not it is "playing".

Kits consisting of Compactron devices and other devices for alarm sensing, pre-tuning and volume presetting can be made available to radio manufacturers. GE reports the system can be adapted to FM receivers and television sets.

Sentinel Service: A prototype transmitter and a transistorized radio set that automatically sound an alarm and turn on even when "off" have been demonstrated by Philco Corp. The radio, set at a "Sentinel" frequency, automatically returns to standby when no alert instructions are broadcast.

According to Philco, cost to the customer will be about $10 extra on a standard transistor set. Broadcasters will be able to install needed transmitting equipment for less than $100. Philco states that the special circuit, on standby, would operate for 30 to 45 days on standard D batteries without recharging. The company has developed a device to adapt the scheme to pocket-size transistor radios.

Disaster Alerting Device: A device that turns on a radio or television set, adjusts the volume and tunes the set to the "alerting" frequency upon receipt of a 1,000-cps signal sent at a dropped rate of about 40 cps has been patented by T. W. Powell of Joe Simpkins Oil Developments, St. Louis, Mo. The energized set would be locked to the alerting frequency until completion of the emergency broadcast.

The DAD scheme is for inclusion in or attachment to radio and television sets, ac or dc and battery powered. It has been demonstrated to civil defense officials in Battle Creek and Atlanta. Permission to broadcast the coded signal for a public demonstration in Atlanta was requested of FCC in late 1959.

According to Powell, cost of including the DAD device in an original set would cost the manufacturer $2 to $2.50. Conversion kits would cost up to $11 installed.

Says TVA Group Guards Interests of Consumers

Woltersdorf tells TVPPA distribution group lawyers studying post-Philadelphia action

K. A. WOLTERSDORF, manager City of Huntsville Utilities, states TVA distributors' policy on suing manufacturers

"We are not lawsuit happy, we do not wish to engage in long and expensive litigation, nor do we have any feeling of animosity or dissatisfaction. But we do have to look after the interests of our consumers."

Thus K. A. Woltersdorf, City of Huntsville Utilities, summed up the attitude of his organization toward damage suits in the wake of the Philadelphia cases involving many electrical manufacturers. He expressed this view at the annual meeting of the Distribution Practices Section, Tennessee Valley Public Power Association, recently at Nashville, Tenn.

Woltersdorf conceded that a group of distributors of TVA power have employed a legal firm to study their purchases and determine whether suits would be filed.

TVA is considering a 500-kv transmission line for operation in 1966, said K. E. Hapgood, director of power planning and engineering.

TVA had earlier considered this EHV connection for Paradise Plant's No. 2 unit to the system, he said, noting that studies showed 500 kv was not economical. Accordingly, the unit will be connected at 161 kv.

Hapgood pointed out that with a 10,000 Mw-system, TVA expects a 10,000-Mw growth by 1970 and a 20,000-Mw growth in the following ten years, bringing the load to 40,000 Mw by 1980. These developments, he said, will require that larger blocks of power be transmitted.

Hapgood said that EHV provides economies by permitting generating plants to locate in the coal fields, thus saving coal transportation costs, or by reducing the costs of transmission as well. Comparing 161 and 500 kv for the transmission of 700 and 1,000 Mw, Hapgood said that requirements and costs would be as given in the accompanying table.

Costs and Requirements Compared for Different Voltages over Varying Distances

	150 Miles		250 Miles	
For 700 Mw:	**161 kv**	**500 kv**	**161 kv**	**500 kv**
Circuits required	5	2	8	2
Relative construction cost	1.00	1.00	1.00	0.60
Relative cost incl. losses	1.00	0.85	1.00	0.55
For 1,000 Mw:				
Circuits required	7	2	11	2
Relative construction cost	1.00	0.75	1.00	0.45
Relative cost incl. losses	1.00	0.65	1.00	0.42

Offers Computer Assistance

TVA's computer and personnel are available for working out programs for engineering studies for cooperatives and municipals distributing TVA power, William R. New, chief, Market Analysis Branch, told the conference.

New said that system studies are under way for the Loudon system. The study will analyze distribution transformer loadings and distribution circuit loads, with particular attention to phase balancing on feeders. Customer metering information is used, and the fact that TVA handles billing on the computer for many distributors simplifies the studies.

New said that transformer load studies may be made for as little as $25 per month for a system of 10,000 meters when punch cards are furnished with information on which customers are served by each distribution transformer.

For $15 more per month single-phase load data can be calculated for the same system. Costs are slightly more for larger systems. New urged the standardization of record keep-

(*Continued on page* 109)

Utility-Industrial Teamwork Needed

Texas Conference told engineers must co-operate to fit utility service to the needs of today's critical industrial processes

Utility and industrial engineers must cooperate early in the design of utility service and plant electrical systems to provide adequate service for today's highly automated industrial processes, a panel of utility engineers moderated by C. J. Barras, Dow Chemical Co, told the 14th Annual Power Distribution Conference recently at Austin, Texas.

The utility engineer must design to meet the industrial's special requirements, said Jack Davey, Louisiana Power & Light Co, in a paper co-authored by H. L. Deloney. The industrial designer must plan to use most advantageously the service the utility will supply. Mutual understanding can lead to optimum performance, but lack of understanding can require costly modifications after the plant goes into operation.

Davey noted that momentary outages and voltage dips caused by faults have become increasingly important. This has come about, he said, because of advances in the control of lightning as well as the increasing dependence of modern industrial processes—especially in chemical plants—upon the continuously controlled operation of all components.

Protection against complete, prolonged loss of power can be provided by duplicating the supply facilities and protecting them against lightning, wind, ice and fire damage, Davey said. And momentary interruptions can be minimized by fast switching or rapid in-plant transfer of critical drives to an emergency power source. Parallel supply is preferred, he said, but automatic transfer before acute slowdown is often acceptable. For the latter, he observed, under-frequency relays set at 58 cps are often more sensitive than undervoltage relays set at 85%, because the voltage may be held up by motor self-excitation, particularly where shunt capacitors remain connected.

Momentary dips may prove troublesome, Davey said, because conventional solenoid-held control devices drop out in one cycle at 30 to 50% voltage. He recommended that starters for critical motors be modified for immediate re-start upon restoration of voltage, but warned that currents approaching locked-rotor could cause seriously low voltage if too many motors were re-started simultaneously.

Close communication between industrial and utility design engineers contributes substantially to co-ordinated protection of electrical supply to industrial customers, said R. E. Sypert, Houston Lighting and Power Co, and satisfactory operation calls for very close cooperation between their operating organizations. The Houston utility asks that its dispatcher be consulted for all scheduled switching at customers' substations and be advised promptly of all emergency switching or breaker trips.

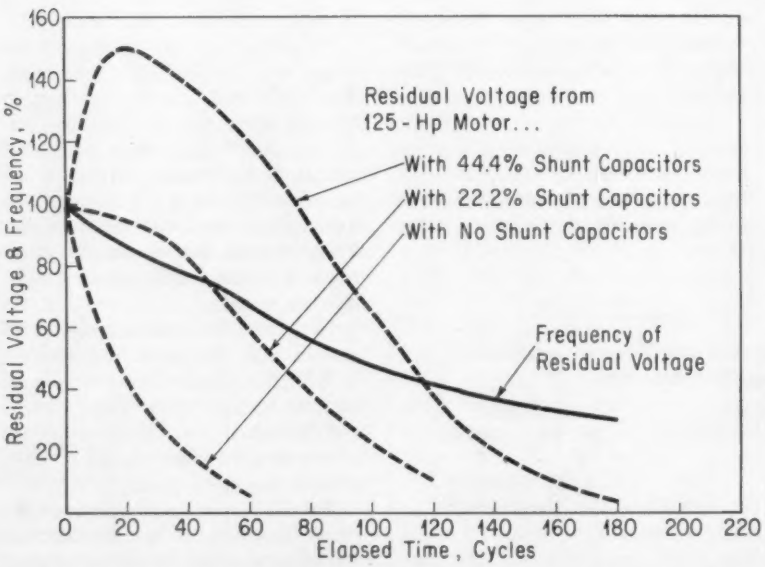
Loop Protection Is Factor

Where a line is looped through a customer's substation to guard against occasional interruptions to a critical process, Sypert pointed out, customer-owned equipment becomes a part of the utility's system and must be relayed accordingly. Such installations may require impedance or reactance line relays set so their 3rd zones provide backup for adjacent line sections. Ground-fault protection could be instantaneous directional-overcurrent with carrier, backed up by directional induction-overcurrent relays. Breakers on supply lines normally have two automatic reclosures, he said.

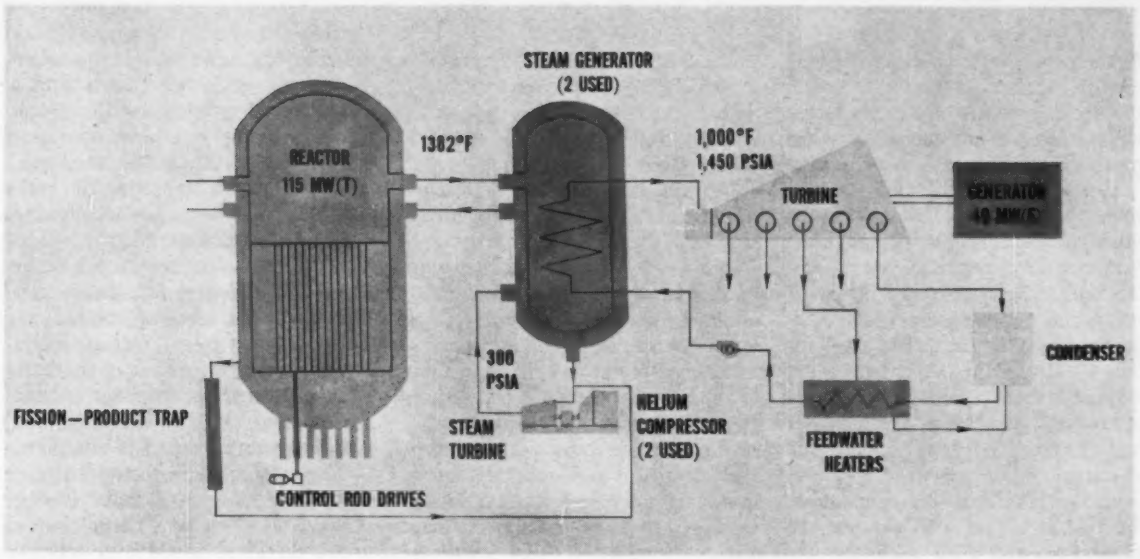
Where the industrial then extends high-voltage feeders from the main substation, these feeders must be tripped instantly for a fault, he added. Any coordination difficulty this creates in plant relaying can usually be resolved by the use of differential or pilot-wire protection.

Difficulties in starting and attaining optimum performance of large motors can be resolved by close cooperation, said H. J. Sutton, Gulf States Utilities Co. This cooperation should recognize (1) the duration of starting current, up to 13 sec in some cases; (2) the effect of heavy reactive current on system voltage, which tends to impair pull

(*Continued on page* 101)



RESIDUAL FREQUENCY from 125-hp compressor motor with capacitors provides better initiation of transfer during power outage than the residual voltage



HELIUM FROM THE REACTOR supplies two steam generators, one of them shown here, which are forced-recirculation type and rated at 182,750 lb per hr. Helium exit temperature is 622F. The turbine-generator will be outdoors

HTGR to Have Carbon-Steel Vessel

Completion of Peach Bottom estimated for March 1964
Steam conditions of 40-Mw unit to be 1,450 psi, 1,000F

G. H. BOSWORTH, Project Engineer, Bechtel Corp, San Francisco, Calif.

CORWIN RICKARD, Design & Planning Engineer, General Atomic Div, General Dynamics Corp, La Jolla, Calif.

The Peach Bottom Atomic Power Station, now being designed, is expected to produce the first commercial electric power from a high temperature gas-cooled Reactor (HTGR) system. The 40-Mw plant will incorporate an advanced, compact, graphite-moderated, helium-cooled reactor, designed to use graphite-clad fuel-moderator elements. Application to larger HTGR plants with operating conditions demonstrated by this prototype is expected to lead to power costs competitive with conventional power in many areas of the United States.

Philadelphia Electric Co will own and operate the prototype HTGR plant, to be located at Peach Bottom in York County, Pa., 63 miles southwest of Philadelphia. Associated with PE Co in the financing of research and development for the project are 52 other utility companies that make up High Temperature Reactor Development Associates, Inc (HTRDA).

Research and development funds up to $14.5 million are being provided to General Atomic by the Atomic Energy Commission as part of the Commission's third-round demonstration program. This is in addition to the $24.5 million contributed by PE Co and HTRDA under a fixed price contract for research, development and construction. The AEC will also waive $2.5 million in fuel-use charges.

Steam conditions of 1,000F, 1,450 psi will permit the use of a modern, efficient turbine-generator. High power densities in the reactor and steam generator makes possible a drastic reduction in size and expected cost per kw compared to previous gas-cooled reactors.

Gas Cooling Attractive

From the earliest days of nuclear power it has been recognized that the freedom from corrosion difficulties and temperature limitations offered by gas cooling are fundamental attractions. Early gas-cooled reactors, however, were fueled with natural uranium and proved in practice to have low power densities, which raised their capital costs. Also, available temperatures were limited by the metals used for surface extension and fuel cladding.

With the HTGR plant, the benefits of gas cooling are obtained without the low power density handicap by using enriched uranium and graphite cladding of the fuel. These permit large temperature differentials and use of the moderator for surface extension of the fuel.

Since graphite-moderated cores are nearly all moderator with very little fuel volume (the carbon-uranium atom ratio is about 2,500:1), using the moderator surface for cooling represents a large addition to heat transfer capabilities. This is so effective that optimum power densities of 6 to 8 kw per liter of core are obtainable without excessive coolant pumping power.

The high coolant outlet temperature available with graphite-clad fuel not only results in high thermal efficiency and hence lower fuel costs, but is also very effective in lowering capital costs. The 1300-1400F outlet temperature range permits modern steam conditions. At the same time, there is available in the steam generator a large temperature difference, which greatly reduces the surface area needed for heat transfer and thus the cost.

The reactor inlet temperature, 660F, is about as high as the outlet temperature for earlier gas-cooled reactors. This temperature is high enough to minimize radiation damage to the reflector graphite and pressure-vessel steel. And it is low enough to permit the use of carbon-steel vessels and piping. Also,

fortunately, the temperature is high enough so that feedwater temperature and pressure can be selected without special consideration to the pinch point in the steam generator.

Considerably higher fuel burnup than previously obtainable with other reactor concepts will make the fuel cost low and the power cost less dependent on fuel buy-back price and reprocessing costs. Expected core life is three years for the 40-Mw plant. A larger plant with still better neutron economy is expected to achieve a still higher fuel burnup and have a core life in excess of five years.

In the HTGR-type fuel element, the fuel is mixed with part of the moderator and clad with the remainder. The resulting high dilution of the fuel by the moderator, about one thousand carbon atoms to each U^{235} atom, means that even complete burnup of the fuel affects only a small fraction of the fuel compact structure. Consequently, little or no damage to the fuel compact is expected at burnups of 50,000 to 100,000 Mw-days per ton of total contained fuel: i.e., U^{235} and thorium. Loss of reactivity from fission-product buildup and depletion of fuel sets the burnup limit, rather than mechanical destruction of the fuel element.

A long reactivity fuel lifetime is obtained because of the absence of neutron-absorbing structural materials in the core and by the use of thorium as the fertile element. Optimization studies showed thorium plus U^{235} to have a fuel-cycle-cost advantage over slightly enriched uranium. This would be particularly true in large HTGR's in which the burnup achievable is so high that the major portion of the energy from a single core loading comes from the U^{233} bred.

An extensive program for development of the HTGR reactor underway by General Atomic at San Diego has to date involved development and testing of fuel elements and the fission product control system. This work, including performance tests of the graphite-uranium-thorium fuel bodies, has emphasized in-pile, capsule and loop experiments. Many irradiation tests of the fuel compact and graphite sleeve materials under various simulated reactor operating conditions have already been successfully completed and others are still underway. A high-temperature in-pile loop will test the fuel element and its ability to achieve low contamination of primary-circuit components. Many tests pertinent to the development of the fission-product trapping system are also in progress.

Test for Rod Worth

The program in reactor physics includes the solution of problems associated with the high operating temperatures, with the high burnups anticipated and with the use of thorium-U^{235} fuel. A critical assembly is being used to carry out integral experiments and to confirm estimates of control rod worth and the resonance absorption in thorium.

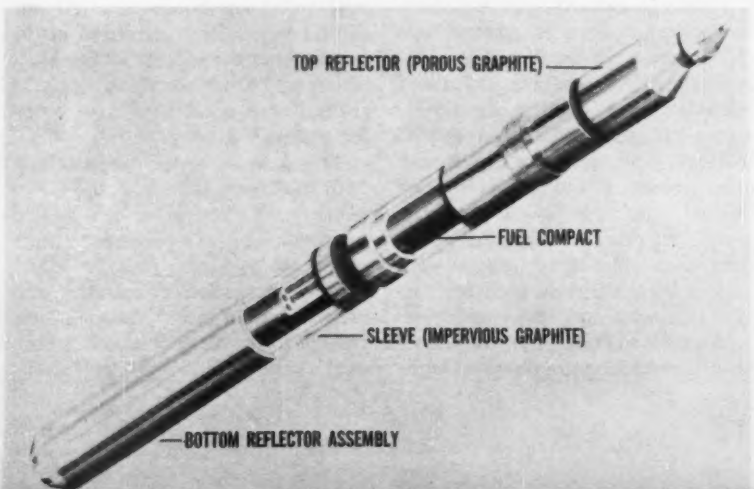
Current development work on components includes design and testing of control rod drives, fuel-handling equipment, steam generators and helium circulators to ensure reliable operation and low coolant leak rate. A facility for testing a complete prototype control rod and drive assembly has been operating for several months. This facility is also being used for testing the fuel-handling machine. In addition to direct work on the coolant purification system, experiments are being conducted on mass transfer of carbon in the presence of coolant impurities. Heat transfer and coolant flow experiments to verify the core thermal design are in progress, and preliminary design work on the reactor pressure vessel is complete.

The reactor core is homogeneous: i.e., the graphite moderator is part of the fuel elements. The elements are cylindrical and are aligned vertically, with the space between the elements forming the coolant passages. This arrangement permits a much larger heat transfer surface per unit core volume than in a heterogeneous design and, consequently, a much higher core power density. Simultaneously, it permits the use of large, rugged fuel elements of 3.5 in. dia rather than the complex assemblies of small-diameter rods in heterogeneous cores.

There are 859 cylindrical elements consisting of 804 fuel elements, 36 control rods and 19 emergency-shutdown rods. The bottom and top neutron reflectors 2 ft thick are made an integral part of the fuel elements. The side reflector, which extends the full height of the fuel elements, is also 2 ft thick and is made up of a row of dummy graphite elements and a concentric ring that encloses the core. The core and reflector are surrounded by a steel thermal shield. Coolant gas flows through the coolant passeges formed by the thermal shield and the pressure vessel wall and through the side reflector before flowing up through the reactor core. A shroud above the core serves as a thermal barrier between the outgoing hot helium and incoming cooler helium and is connected to the coolant outlet from the reactor.

Fuel for the reactor consists of U^{235} carbide and thorium carbide dispersed in graphite in the form of short compacts. These are contained and supported in a graphite sleeve the height of the core. The moderator graphite serves the additional functions of cladding material, fuel support and fuel diluent, so

FUEL of U-235 carbide and thorium carbide dispersed in graphite moderator is clad with a graphite sleeve. Short lengths are stacked to make 12-ft element



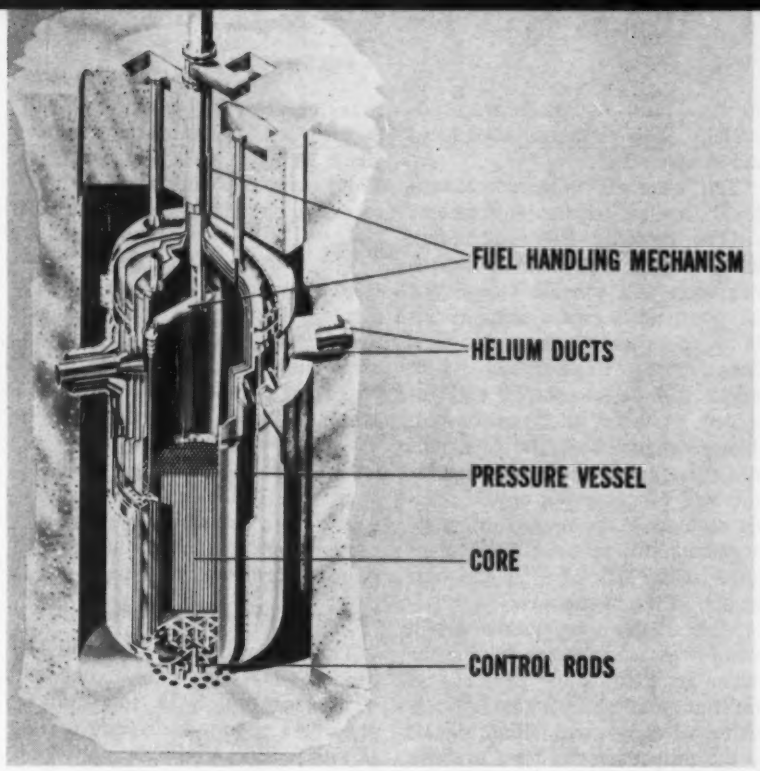
eliminates the need for otherwise unnecessary neutron absorbers for these functions. A complete fuel element assembly is a 12-ft-long, 3.5-in.-dia cylinder.

To maintain the required purity of the helium and to prevent fission products that escape from the fuel compact from reaching the main coolant stream, a helium purification system is provided. Purge streams of helium coolant, directed along channels between the tubes and the fuel compacts, are extracted from the fuel elements at their individual base support points and carry fission products escaping from the fuel to an external trapping system. Fission products and chemical impurities removed, the purified helium returns to the primary loop.

The core geometry, high temperatures above the core and accessibility for fuel handling make the location of control-rod-drive assemblies below the core the logical choice. Control rods within the core move in graphite guide tubes. A guide tube on its outside is similar to a fuel element except that the low section extends into an adapter on the grid plate. A control rod and its guide tube are moved as a unit when replaced in the core. This unit is transported by means of the reactor fuel-handling system.

During fuel-changing operations, the reactor is shut down, the core is cooled, and the coolant pressure is reduced to slightly below atmospheric. Shielding plugs are removed from parts that penetrate the reactor vessel, and a charge machine and a fuel-transfer machine are secured to flanges on the access ports. The fuel-transfer machine is then lowered into the vessel, where it serves to move fuel elements between positions in the core and positions in the reflector.

A spent fuel element to be removed from the core is raised out of its position by the fuel-transfer machine and transferred to a parking space below the unloading port. From here, the element is raised by a cable into a charge machine cask and rolled to a position over a spent-fuel canning machine. This encloses spent fuel elements in a loosely fitting metal can before it is discharged to a spent-fuel storage pond for cooling. New fuel elements are lowered into the reactor by the charge machine.



FUEL-HANDLING MACHINE raises elements for refueling. Helium leaves the reactor through the inner pipe, returns through the outer, then to below the core

The primary coolant system consists of two steam generators and two helium compressors with related piping and auxiliaries. They are arranged to form two parallel helium loops, each designed for half the total coolant flow.

Helium leaving the reactor core splits into two streams, each of which supplies one steam generator loop. In each loop, helium at 1,382F leaving the reactor vessel flows through the inner of two concentric pipes to the top steam generators. The steam generators will be of the forced-recirculation type and rated at 182,750 lb per hr steam at 1,450 psi, 1,000F. Helium exit temperature is 622F.

Electric End Conventional

The electric generating portion of the plant features an outdoor single turbine-generator unit. The equipment will be of conventional design and maximum reliability consistent with economical plant design. The turbine is a 3600-rpm tanden compound, double-flow, condensing unit capable of producing 40,000 kw net electrical output with 1450-psig, 1000F steam at throttle.

The main condenser performs several functions, as is typical of all nuclear generating plants:

1. It condenses steam from the turbine to maintain the desired vacuum.
2. It dearates the condensate, makeup water, heater drains and other returns.
3. It serves as a heat sink for main steam flow during reactor startup or emergency shutdown conditions.

Condensate is pumped from the condenser through three feedwater heaters, then by a steam-generator feed pump through one high-pressure heater to the steam generators. A reduced-capacity feed pump will be used for startup and shutdown.

Two types of service water cooling systems are used. The first serves plant functions that could not become radioactive even with equipment failure. In this system, which includes the hydrogen seal oil cooler, turbine lube-oil coolers and hydrogen coolers, the service water circulates directly to the exchanger. The second group of systems may become radioactive by equipment failure. In them, a closed cooling-water loop, always maintained at a pressure less than service water

pressure, transfers heat between potentially contaminated equipment and service water.

Ten channels utilizing conventional nuclear-reactor instruments will be provided for neutron-flux measurement. The nuclear instrumentation will provide signals for the plant protection system in addition to providing reactor signals during startup. Reactor temperature points will be monitored and recorded by the reactor temperature channels, which will provide signals to the proper circuits. Gas temperature will be measured at the reactor outlets. Pressure-measuring instruments will monitor the coolant loops at the reactor inlet and outlet and at the circulators.

Moisture detecting epuipment will monitor the coolant gas leaving the steam generator. The presence of moisture, indicating steam generator tube leakage, will initiate signals to the proper circuits for corrective action. Gamma-ray detectors will provided to monitor the radioactivity levels adjacent to each major reactor-plant component. In addition to providing signals to the alarm circuits, these detectors will provide a record of the activity level to indicate any trend toward activity accumulation. Mass-spectrometer helium-leak-detecting equipment will be provided to monitor the area adjacent to major system components. This equipment will provide signals to alarm circuits in case of helium leaks.

The function of the reactor protection system is to protect equipment and personnel through such measures as actuating alarms and scramming the reactor. One of its important functions will be to determine which helium coolant loop has failed, then to remove it from service without affecting the other loop. The system will provide signals to close automatically necessary containment penetrations under various abnormal conditions.

Spurious Scrams Prevented

The system consists of two independent fail-safe safety channels which must both be de-energized to produce a scram. Failure of a single component or power supply does not prevent a required scram or cause a spurious one. Wherever practical, the two channels are physically separated and clearly identified so as to minimize the possibility of maintenance personnel's causing an accidental shutdown.

The containment structure will consist of a cylindrical steel shell with a dished top. During reactor operation, the containment will be supplied with a reduced oxygen atmosphere in order to limit the potential consequences of accidents involving the integrity of the primary loop. An air compartment will be located inside the containment for equipment requiring access during operation of the reactor. Penetrations will be made for steam and feedwater lines, ventilation ducts and electrical cables. Containment integrity will be protected by leak-tight penetrations and by automatically closing valves. Personnel access to the containment will be by means of an air lock to the air room and an autoclave door at the operating floor elevation. Equipment access at ground floor elevation will be by a large autoclave door.

The biological shield around the reactor is ordinary concrete. Major components of the primary coolant system and the auxiliary helium systems are located in a concrete-shielded compartment.

To increase power when the plant is operating, the turbine throttle valve is opened to increase steam flow through the turbine. A control signal proportional to steam flow and deviation of steam pressure from standard is transmitted to the helium circulator speed controller. The resultant increase in helium flow rate reduces reactor temperatures; this is followed by an increase in reactor power level as a consequence of the prompt negative temperature coefficient of reactivity. Steam temperature is increased by automatic actuation of the reactor regulating rod to rise the average operating temperature and power of the reactor. Reactor outlet-gas temperature overrides the steam-temperature signal to reduce reactor power if the outlet temperature exceeds the design maximum. When a decrease in power output is desired, the turbine throttle valve is closed to reduce steam flow and reverse the other system functions described.

[Completion date, initially scheduled for 1963, depends on when the AEC construction permit is obtained (EW, Jan. 9, p 25). Hearing for it is scheduled for Dec. 18. Meanwhile, design and development are proceeding at General Atomic and Bechtel; the estimated completion date is now March 1964].

Technical Data for the HTGR

Operating Conditions

Coolant pressure	350 psi
Coolant inlet temperature	634F
Coolant outlet temperature	1,380F
Maximum fuel surface temperature (approximate)	2,700F
Steam temperature	1,000F
Steam pressure	1,450 psia
Net thermal efficiency	34.8%
Reactor thermal output	115 †Mw

Reactor Parameters

Fissile investment (U^{235})	170 kg
Thorium investment	1,990 kg
Core diameter	9.16 ft
Core length	7.5 ft
Core coolant voidage	12.8%
Fuel element diameter	3.50 in.
Number of fuel elements	804
Reflector thickness	2 ft
Pressure vessel diameter (inside)	14 ft
Pressure vessel height	37 ft
Core graphite-to-uranium ratio	2,300
Fuel burnup:	
Fission per original fissile atom	0.6
Core life (at 80% capacity factor)	3 years

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ELECTRIC UTILITY METHODS

OPERATIONS & CONSTRUCTION

Fourth Conductor Simplifies

J. L. **UPCHURCH, JR,** Construction Coordinator, Carolina Power & Light Co, Raleigh, N. C.

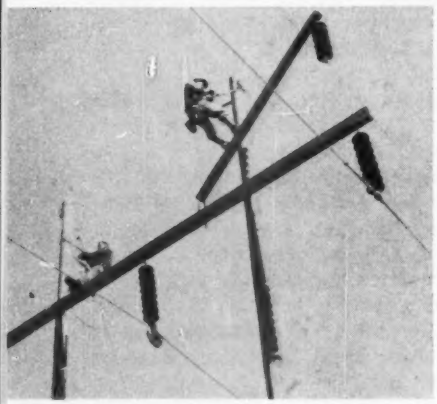
Twenty-nine miles of Carolina Power & Light Co's 110-kv transmission line out of Jacksonville, Fla., were recently reconductored, one phase at a time, without interrupting service, by using a fourth conductor in temporary position to carry load on each phase as the conductor for that phase was being replaced.

Carolina P&L was faced with the problem of replacing No. 2/0 copper phase wires on a 110-kv line that was the only source of supply to the area. The 29-mile line ran from the Jacksonville substation to Point C (see chart on page 81). The job was divided into three sections. Section 1 extended from Jacksonville substation a distance of one mile to Point A. Section 2 extended from Point A, a distance of five miles, to Point B. Section 3 extended from Point B, a distance of 23 miles, to Point C. The ends of sections were marked by dead-ends and changes in line direction, which were determining factors in their selection.

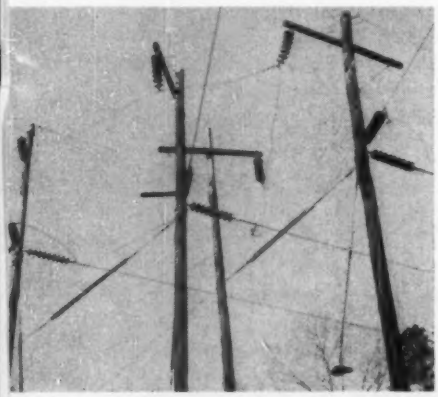
The line structures are the shielded wood-pole H-frame type with 14 ft between pole spacing and 30-ft crossarms installed nine feet from the top of the pole. The average span is 500 ft and many structures are cross-braced. The No. 2/0 copper conductors were to be replaced with 795 MCM ACSR in two sections of the line and 556.5 MCM ACSR in the third section.

Section 1 paralleled another 110-kv line so the load was carried on the parallel line while the reconductoring was being performed on a de-energized line. While tapping this line and handling the jumpers, crews gained confidence that the heavy jumpers required for work on the other sections could be handled "hot".

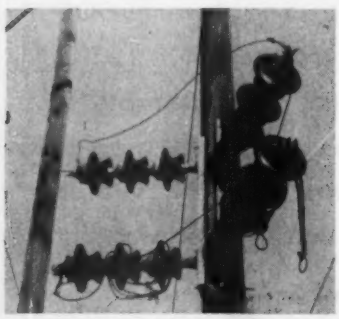
To handle the reconductoring work on sections 2 and 3, a fourth conductor was required. Work was done on one section at a time. Temporary arms of 4 x 6 in., 12-ft-long untreated timbers were installed on the H-frame structures. These temporary arms were installed at an angle to the poles with a machine bolt through the pole and with a shackle made of two straps bolted through the temporary arm and underneath the permanent arm.



TEMPORARY ARMS were fastened to poles with machine bolts and to permanent arms with a shackle made of two straps



JUMPERS were installed to the temporary conductor for use in transferring load from one conductor to the other



DISCONNECT AND CUTOUT units aided load transfer

Load Transferred, No Outage

The load was transferred from one conductor to another without an interruption. This was accomplished with a parallel-connected 69-kv blade disconnect and a 69-kv cutout mounted on 110-kv insulator stacks. The newly installed conductor was energized in parallel with the disconnect and the permanent jumper was installed on the conductor. The charging current was broken at a line jumper by installing the disconnect and fuse across the section of line to be opened. By closing the disconnect, which was in parallel with the jumper to be opened, the line was opened by cutting or removing the line jumper. Then the fuse was closed and the disconnect was opened and the charging current blew the fuse, breaking the parallel. In anticipation that the load might not blow the fuse, a wire ring was fastened to the lower end of the fuse element so that a man with a 20-ft switch stick could manually break the fuse link. After one new conductor had been installed in the position provided by transferring the existing 2/0 copper conductor to the temporary position, the load of the temporary phase was transferred to the new conductor and the load of the center phase was transferred to the No. 2/0 copper in the temporary position. Details of load transfer in relation to a system schematic drawing are described on opposite page.

The conversion process was repeated from one phase to the other, connecting the conductor in the temporary position in the circuit to handle the load of one phase while the conductor on that phase was being replaced. On the second and third phases,

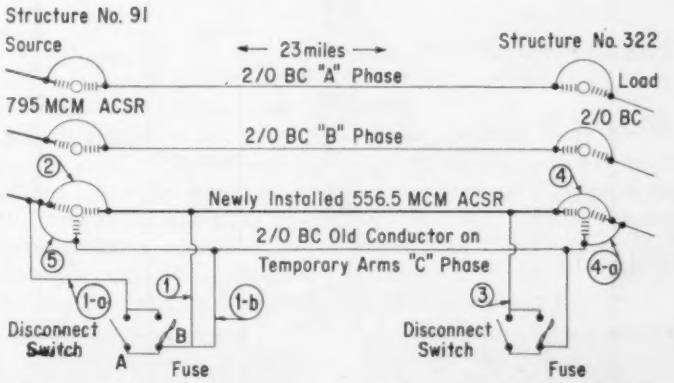
Reconductoring Energized 110-Kv Lines

the new conductors were pulled in as the old conductors were pulled out. When the new conductors were all in place and operating, the conductor in the temporary position and the temporary crossarms were removed. When work on Section 2 was completed, the entire process was repeated as conductors were replaced in Section 3.

Tension Structures Converted

Double-arm tension tangent structures were converted to double-arm suspension structures by installing new arms above the existing arms, so the conductor in the suspension string would be at the elevation of the existing conductor, maintaining the same ground clearance. Since the existing tension strings were installed with eye nuts on the ends of double-arming bolts, the conductor was transferred to its temporary position by cutting the ends of the arms next to the double-arming bolts and transferring the bolts, tension strings and arm tips to a temporary position. The existing double arm was cut off the pole providing space for the new suspension string and conductor to be installed on the end of the new arm. This procedure was followed on the second and third phases by cutting down the section of arm not supporting the old energized conductor.

At light angles in the line, double-arm tension structures were rebuilt and converted to three-pole suspension-angle structures. The ends of the existing arm were cut and the conductor transferred to the temporary position. The remaining section of the arm was cut to allow space for an insulator string for the new conductor to be attached to the pole. The third pole required in the conversion of a double-tension structure to a three-pole suspension structure was installed on the outside of the angle with spacing equal to that of the existing poles. On two, very small angles "V" suspension strings were used to assure phase-to-pole clearances under all conditions.



Load was transferred from one conductor to another by installing jumpers, a disconnect switch and a fuse switch, at each end of the section of line where the load was to be transferred, as shown above. At the source end of the line section, **Structure 91**, Jumper **No. 1** was installed first from the disconnecting fuse to the newly installed conductor and then Jumper **No. 1a** was connected from the disconnect to the source side of the structure. The disconnect was closed, energizing the new conductor. Permanent Jumper **No. 2** was then installed between the newly installed conductor and the corresponding phase on the source side of the structure. The disconnect was then opened.

At the other end of the line section, on **Structure 322**, Jumper **No. 3** was installed between the newly installed conductor and the disconnect. Jumper **3a** was installed between the fuse and the old conductor in the temporary position and on the source side of the structure. The disconnect was closed. Permanent Jumper **No. 4** was then installed.

Original Jumper **4a** was removed, the fuse was closed and the disconnect was opened. If the parallel load did not blow the fuse it was broken manually. Jumpers **3** and **3a** were then removed.

At this time the two conductors were energized in parallel through line jumpers at **Structure 91**, Point **B**. The old conductor in the temporary position carried only line-charging current. Jumper **No. 1** was then removed from the new conductor and Jumper **No. 1b** was installed to the old conductor in the temporary position on the load side of **Structure 91**. The disconnect was closed and original Jumper **No. 5** was removed. The fuse on **Structure 91** was then closed and the disconnect was opened. If the fuse did not blow it was broken manually, breaking the charging current on the old conductor in the temporary position. Jumpers **1a** and **1b** were then removed from the line.

Engineering Reference Sheet

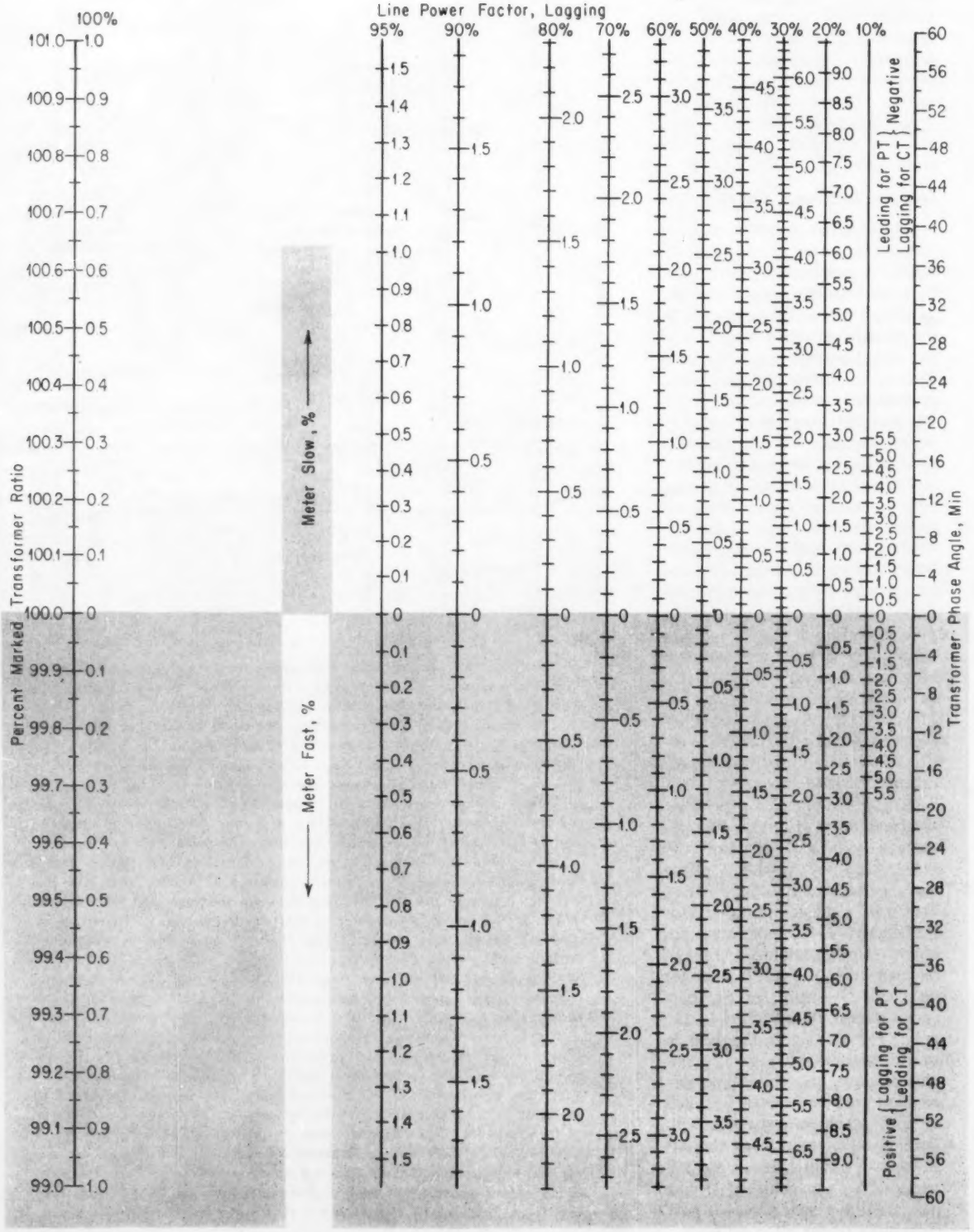

Line Power Factor, Lagging
95% 90% 80% 70% 60% 50% 40% 30% 20% 10%
100%
Percent Marked Transformer Ratio
Meter Slow, %
Meter Fast, %
Leading for PT } Negative
Lagging for CT }
Positive { Lagging for PT / Leading for CT
Transformer Phase Angle, Min

Chart Shows Corrections for Current Transformer and Potential Transformer Errors

This nomogram shows the combined effect on watthour meter registration of phase-angle and ratio errors in instrument transformers.

It is set up for unity and lagging power-factor loads only. Accuracy curves on instrument transformers show "percent marked ratio" and this indicates the relation between the actual ratio of the transformer by test and the perfect ratio for which the transformer is designed. A marked ratio of 99.9% would mean that the ratio between primary and secondary is 0.1% less than it should be. This results in greater secondary current or potential, whichever the case may be, than designed for and tends to increase meter registration. The extreme left-hand vertical scale is marked in percent marked transformer ratio.

The effect of phase-angle error on the reading of a watthour meter connected to the secondaries of instrument transformers depends on the power factor of the load or line being measured. Furthermore, the effect of phase-angle error has opposite tendencies in current transformers than in potential transformers. Any phase-angle error that tends to increase the reading of a meter connected through an instrument transformer is conveniently called positive, while a phase-angle error that decreases the meter reading is called negative. A lagging angle is positive for a PT but negative for a CT. The extreme right-hand scale is marked in minutes of phase-angle error, negative above and positive below the zero line.

With phase-angle and ratio errors for a particular burden, as inputs, the user can lay a straightedge across the chart to find the meter's error as a percentage for the proper line power factor. Points above the zero line indicate that the meter runs slow and those below, fast.

Figure Combined Effect

The over-all correction factor of a CT and a PT can be determined in one operation by properly combining the individual errors before entering the nomogram.

Assume a CT with ratio of 100.5% and a PT with 99.8%. Add the two and subtract 100.0. The result is an over-all ratio-correction factor of 100.3%.

Assume a leading phase angle for the CT of 8 min and a lagging phase angle for the PT of 12 min. These are in like sense on the chart and combine to yield a positive angle of 20 min, which has the effect of increasing the meter reading.

Apply the new values of 100.3% and 20 min positive, and the composite correction can be read directly. The chart shows zero correction at a line power factor of 90% lagging.

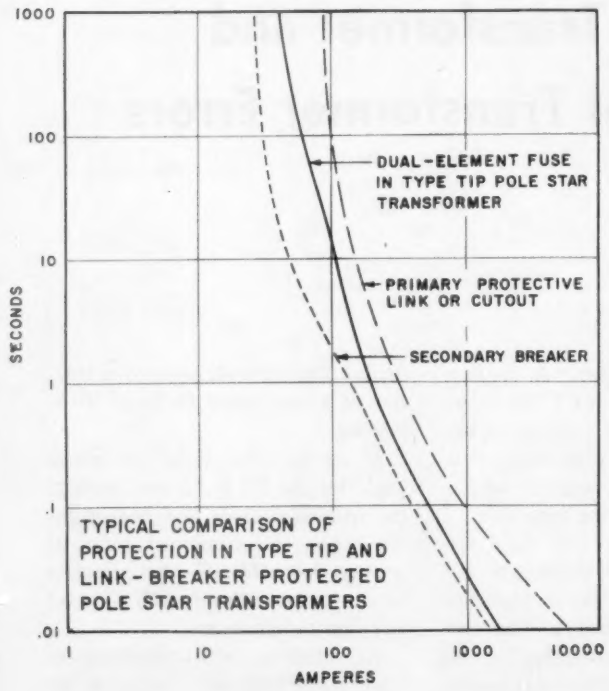
If, on the other hand, the phase angle for the PT is 12 min leading, the combined error is 4 min negative. For the combined ratio of greater than 100.0%, the effect is to cause the meter to run slow at any line power factor.

In dealing with single-phase loads when only one element is involved, it is simply a matter of using the power factor scale that corresponds to the power factor of the load or line. In a three-phase circuit, the problem is complicated because in nearly all cases one watthour meter is working at one power factor and the other element at an entirely different power factor, and neither of these is exactly the power factor of three-phase load.

Any chart of this kind has limitations in compensating meter readings for inaccuracies existing in instrument transformers, especially in three-phase circuits. But when definite standards are set up for permissible errors in instrument transformers, they should be based on the resulting effect of both phase-angle and ratio errors rather than either of the two alone.

The nomogram was prepared by Allis-Chalmers Manufacturing Co's Pittsburgh, Pa., works.

Dual-Element Fuse Protects Transformers

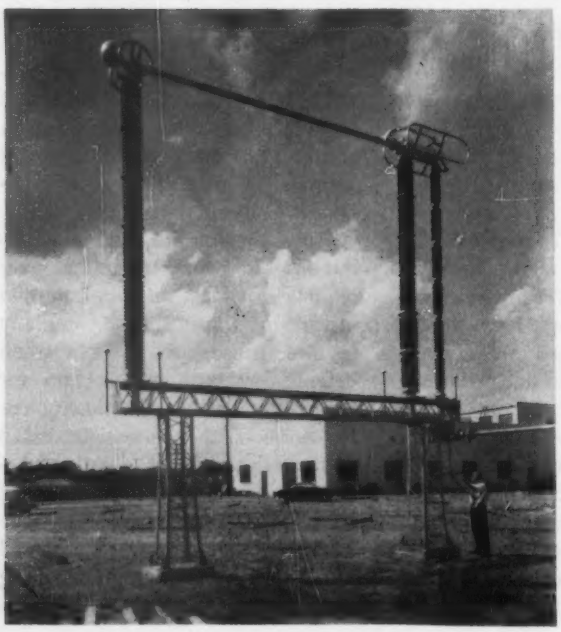


A new member of the Pole Star distribution transformer family, with complete thermal protection provided by a low-cost, dual-element fuse, is announced by Pennsylvania Transformer Division, McGraw-Edison Co. The internally mounted fuse of the new Type TIP transformer does triple duty—protecting for overload, short circuit, and incipient internal-fault conditions. The fuse is said to be readily replaceable.

The new, cartridge-type, dual-element fuse reportedly provides full overload protection without a much-more-costly secondary breaker. One of the two elements used in series protects throughout an overload and low-value-fault range of 2.5 to 20 times rated current. It is designed with thermal characteristics that permit overloading with satisfactory insulation-life expectancy. The other element has a higher continuous-current rating than the overload element and is thermally designed for fast operation in the short-circuit range of 20 to 50 times rated current. By combining the characteristics of the two elements, modern transformer loading practices can be followed without unnecessary fuse blowing during transient high overload conditions.

An additional feature of the Type TIP Pole Star transformer is the protection afforded in the event of an incipient, low-energy internal fault. The low-melting-temperature overload element of the fuse will operate due to excessive oil temperature. The circuit is reportedly opened before an explosive internal pressure is reached.

Penn Transformer offers the Type TIP Pole Star transformer in sizes 10 through 50 kva and voltages through the 18-kv class for 14400/24940GrdY service.



600-Kv Air Switch Successfully Tested

I-T-E Circuit Breaker (Canada) Limited, Eastern Power Devices Division, Port Credit, Ontario, has just completed a series of tests as part of a research program in the design of extra-high-voltage air-break switches.

A complete 600-kv air-break switch was successfully tested. Flashover, corona control, and radio-influence voltage information was obtained on full-size components for future designs at voltages up to 700 kv.

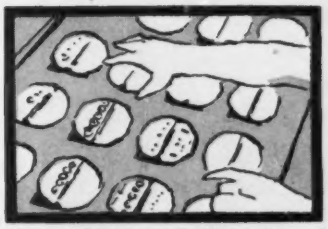
The tests were conducted over a period of a year at the CESI high-voltage laboratory in Milan, Italy. CESI has one of the few laboratories in the world with sufficiently large water-spray equipment for wet flashover tests and the voltage capacity for such a large test object.

Flashover and withstand tests with impulse, power-frequency, and switching-surge wave shapes were performed along with corona control and ri tests.

(*More News of Manufacturers, p* 86)

This certified seal is your assurance of meter quality.

Temperature test is one of several which prove the long-service performance of G-E meters even under extreme conditions.



Meter registers and all other parts must pass precise in-process quality control tests.

Certifying inspectors visually inspect all points of every meter before affixing seal.

ANOTHER GENERAL ELECTRIC METERING EXTRA . . .

18 tests, 356 checks assure meter quality

At General Electric, uniform meter quality is a measurable, documented fact, not an unknown. For example, G-E single-phase meters are *certified* with average accuracy within 0.1% of the reference kilowatt hour, and *certified* 99.9% free from defects which might cause improper registration or operation. And, there are nearly 13,000,000 General Electric magnetic-suspension meters now in service *without a reported bearing failure.*

Exacting quality control makes *certified* G-E meters possible. Skilled technicians and modern, automated test equipment check each meter through 18 electrical tests, 356 points of inspection before the certified seal is applied.

General Electric's pioneering efforts in certification provide uniform high-quality meters of known accuracy and performance, help you cut testing costs. Contact your G-E Sales Engineer for full information.

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YOU GET ALL 10 METERING EXTRAS FROM GENERAL ELECTRIC

- Jet Stream Service
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- Meter Courses
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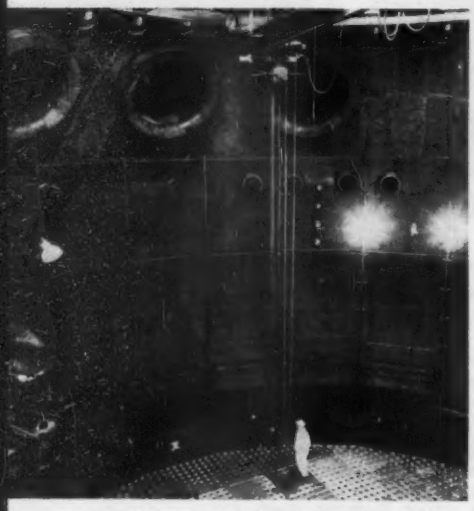
GENERAL ELECTRIC

Britain's Nuclear Power To Reach 3,000 Mw by '66

- 500-Mw Hinkley Point nears completion
- 580-Mw Sizewell Plant takes shape

EACH COOLING-WATER centrifugal pump at Hinkley delivers 93,000 gpm



GRAPHITE LAYING is carried out in Hinkley Point No. 1 reactor vessel

The 500-Mw Hinkley Point atomic power station, Somerset, England, is now in the advanced stage of completion. The No. 1 250-Mw reactor is structurally completed, installation of the instrumentation and fuel-fuse-rupture detection equipment is well underway, all the boilers have been erected and tubed, and the gas circuits virtually closed. The construction lag between No. 1 and No. 2 reactors has been cut from six to five months. Most of the machinery for the six 93.5-Mw turbine sets have been installed.

Fuel loading of the No. 1 reactor is rescheduled for next February in order to incorporate the revised nuclear data of the Atomic Energy Authority. T. G. Wall, chief engineer for the consortium, reports that the revised program has enabled them to uprate Hinkley station from a 20 to a 25-year life—very close to the second-stage stations in the British nuclear power program. About $14 million have been added to the cost of Hinkley, primarily due to the wastage of graphite previously machined to the original tolerances. Latest cost estimates for Hinkley, including modifications and all site development charges, is 364 per kw.

As the Hinkley Point plant nears completion, a 580-Mw nuclear installation is beginning to take shape 200 miles away at Sizewell, on the east coast of England.

Sizewell will be the most powerfull and compact of all seven of Britain's commercial atomic plants, with the cost of electricity expected to be the lowest yet achieved by atomic generation.

Hinkley Point is being built for Britain's Central Electricity Generating Board to power the national grid. English Electric Co, Ltd, Babcock & Wilcox, Co, Ltd, and Taylor Woodrow Atomic Power Group make up the consortium and is responsible for the design and construction of both these gas-cooled, graphite-moderated plants. Work was begun at the Sizewell site this past April.

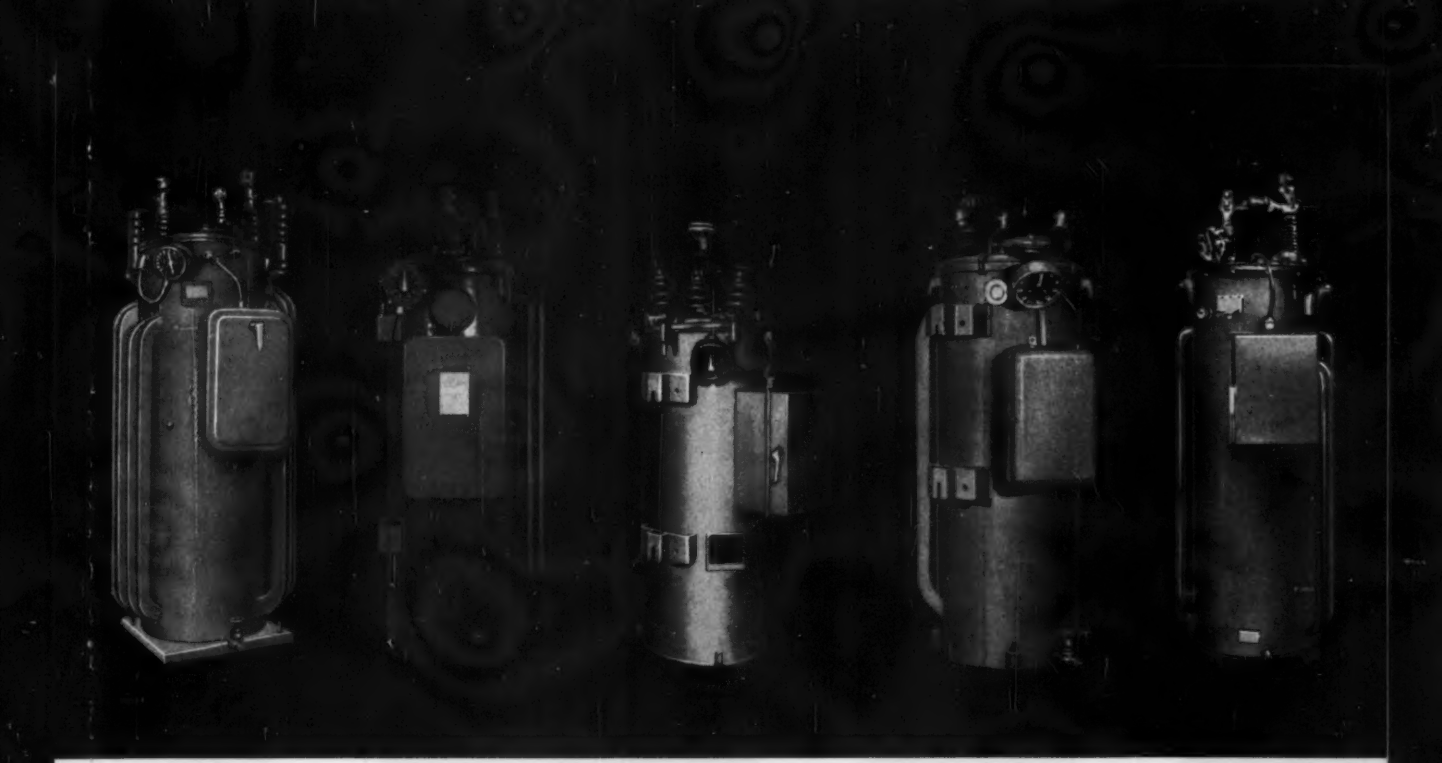
When it comes into full operation in 1966, Sizewell will bring the total power from nuclear stations to 3,000 Mw, or over 10% of that country's present generating capacity.

B&W Offers 400-Mw Spectral-Shift Reactor

Babcock & Wilcox Co is ready to build, with no further research-development work, nuclear steam generators using spectral shift control sized for 400-Mw power plants. The Spectral Shift Control Reactor is an advanced pressurized-water type in which control is achieved by varying the proportion of light and heavy water serving as moderator-coolant in the primary circuit. Working with architect-engineer-constructors, B&W will build such plants at fixed prices and with guarantees on power output and fuel.

The company has already completed preliminary engineering on the SSCR in the 400-Mw size and is ready to proceed with shop drawings immediately upon signing a sales contract. The total price for such a plant is estimated at about $175/kw—or $70 million total, including client costs such as land, escalation, etc. The B&W supply would cover only the nuclear plant, not the entire plant. B&W is not seeking a turn-key contract but wishes to work as designer-supplier of the nuclear steam plant, leaving the over-all responsibility for the plant in the hands of the utility or its chosen architect-engineer-constructor. B&W feels the client is better able to get a competitive price on the non-nuclear part of the plant in this manner.

Power costs of 6.8 mills/kwhr can be achieved with the first core of a large SSCR plant started today, B&W says, using 80% plant factor and 14% carrying charges. This is based on a stainless steel rod core of uranium dioxide pellets. Still lower costs can be obtained with higher plant factor and lower plant charges, or if interest charges on fuel are waived. Costs well under 5 mills/kwhr are expected within ten years.



ALL REGULATORS ARE ALIKE

EXCEPT

IN THE AREAS OF . . .

ACCURACY—Bandwidths of ±¾ volt are possible with the G-E type ML-32 regulator. Why: 32 steps, plus unique Micro-Band* calibrated relay.

LIFE—General Electric regulators are designed to exceed the service life of competitive units. For proof, compare the life expectancy data published by G.E.

ADJUSTMENT—G-E regulator controls are easily adjusted *without voltmeter juggling at pole-top,* by means of dialable voltage level and bandwidth settings. Micro-Band calibrations give micrometer accuracy in 10 seconds (or less).

FEATURES—G.E. eliminates marginal gadgetry. Costs go into truly beneficial features, such as switch strength, internal Thyrite® bypass arresters for more even voltage distribution, and plug-in controls for speedy inspection.

MAINTENANCE—No need to untank G-E regulators for periodic inspection of contacts. Why: electrostatic shielding and Opti-Life switching are features of *all* G-E step regulators.

SERVICE—48-hour emergency shipments of parts is just one of the many extra conveniences available from General Electric's nation-wide network of service facilities on an around-the-clock basis.

FOR ALL THE REASONS WHY G-E regulators are your best Total-Value Buy, contact your General Electric regulator representative. Or, write General Electric Company, Section 456-9, Schenectady 5, N. Y. *Voltage Regulator Products Section, Pittsfield, Mass.*

* Trade-mark of General Electric Co.

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GENERAL ELECTRIC

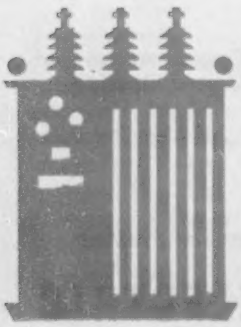
UPTEGRAFF ANNOUNCES

a new design of substation and load center transformers with reserve capacity permitting continuous loading to

115%

OF "PERFORMANCE RATING"

115% supplementary continuous rating without fans, at no increase in price. Conservative thermal design, including the use of INSULDUR insulation, high temperature epoxy-insulated magnet wire, and high temperature transformer oil. These materials permit 15% additional thermal capacity for all conditions of loading.



R. E. UPTEGRAFF MANUFACTURING COMPANY

Scottdale, Pennsylvania • Representatives in Principal Cities

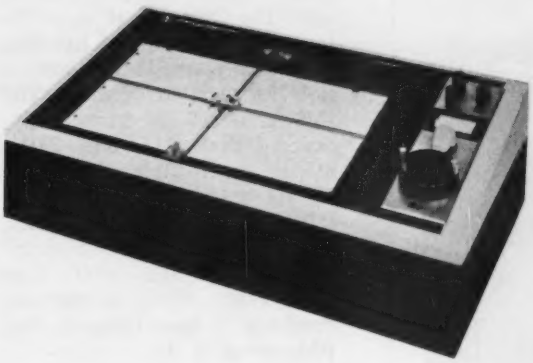
New Equipment

Instrument Transformer . . .

. . . permits shorting the secondary leads without removing the terminal cover. Presently including NEMA sizes A and B, the line covers current ratios of 200:5, 400:5, 600:5 and 800:5 amp in each size. To short the secondary, the knurled thumb screw is loosened, and the terminal cover is raised to a detent position and then turned 90 deg. Optional bases are available in addition to the standard EEI-NEMA mounting base. The new units are suitable for use with ammeters, watthour meters and relays—indoors or outdoors. Each unit reportedly is tested and certified for ratio correction factor and phase angle at 10 percent and 100% of rated current at a standard burden. Manufacturer states that all types have ASA accuracy classification of 0.3 at burdens B-O.1, B-O.2 and B-O.5.

Astra Corp, 314 West Second Street, Boston, Mass.

Recorder . . .



. . . plots any variable vs time on standard graph paper. Models HR-80 and HR-87 T-Y recorders feature convenience in recording and are designed to replace conventional strip chart and circular chart recorders for all applications where a chart length of 10 or 15 in. will provide adequate resolution. Controls permit several parallel records to be run on one chart. Both models include a null-seeking servo which moves an ink pen in proportion to a low level dc input signal on the vertical axis. Stock motors provide many ranges from 10 seconds to 15 minutes full scale. Motors up to 24 hours are available. Amplifier sensitivities are 1 mv and 10 mv per inch. Special amplifiers and graph papers are available for 100 mv to 10 mv full scale on the 7-in. axis of 8½ x 11-in. paper. Accuracy is 0.5% static (or constant velocity) to 7-in. per second on the "Y" axis.

Houston Instrument Corp, Houston 27, Tex.

Hydraulic Backhoe . . .

. . . can be coupled in 30 sec by its Hydra-Hitch quick connect. Its mechanism permits pickup or release on rough ground because it compensates for alignment. Ottawa LX backhoe fits Cat 922 and 944 wheel loaders, as well as 933 Traxcavator. Basic concept of design gives unit tractor-loader versatility. For digging, it has a 12-ft, 6-in. depth, 8-ft, 6-in. dump height and a 190-deg swing, right to left. Cushioning ports prevent "slamming" boom at limits of the swing. Crowd, boom and bucket cylinders are double-acting and reverse-mounted, keeping chrome-plated rods out of dirt. The LX can exert 7,000 lb-force at the bucket cutting edge, with no loss of speed. Two One-Trol levers which simulate operator's natural hand movements control all the movements of the backhoe.

Young Spring & Wire Corp, Bowling Green, Ohio

(*More New Equipment on page* 90)

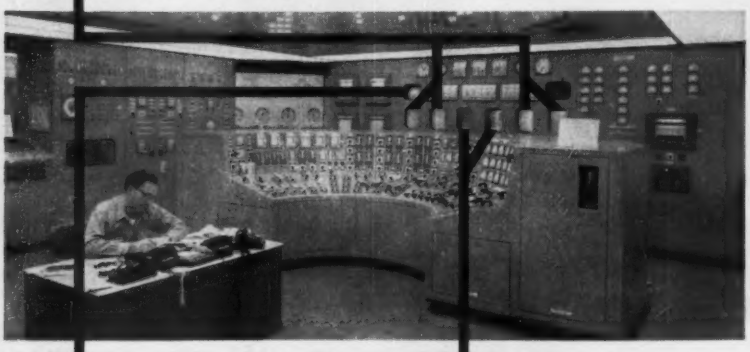
Power Stations Increase

SAFETY, ECONOMY and CENTRAL CONTROL with GPL CLOSED CIRCUIT TV

GPL CLOSED CIRCUIT TV DOES 5 (OR MORE!) JOBS IN 1

The power plant's efficiency is improved by the use of GPL closed circuit TV for centralized observation of its operation. So is safety, through remote, continuous monitoring of furnace burner flames and boiler drum water levels. And closed circuit TV is the only **really fail-safe** telemetering technique! Erroneous transmission is **impossible.** (Illustrations show varied applications of GPL-TV at (New Jersey) Public Service Electric and Gas Company.)

Furnace Observation. A wide-angle view of the inside of a furnace is made possible by a unique new GPL television housing and special lens. Working through a 3" aspirating port, the housing may be inserted or removed conveniently without disturbing furnace operation. Burner lighting and combustion can be observed by control personnel as necessary. GPL systems are available for **all** principal makes of boiler.



Smoke Control. GPL TV permits a convenient check on stacks, enables control room operators to verify that smoke is kept below legal limits and that combustion is most economical.

Gauge Monitoring. Checking on water level in boilers is no problem with GPL TV. A camera in the gauge-glass enclosure at the boiler drum relays the water level picture to the main control room.

Coal Handling. The hoist operator can monitor swing boom and coal moving equipment and coal pile levels in the storage area on pictures relayed to his cab by two outside GPL TV systems.

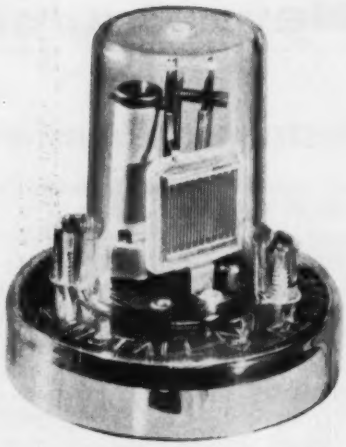
Gate Surveillance. Visitors wishing admittance are identified at the entrance gate from a transmitted picture and can be admitted by remotely operated gate controls after identification.

The above are only a few of the ways this versatile electronic tool can serve the utility industry. Whatever your needs, GPL Closed Circuit TV can help you do **more** jobs **better** and **more economically.**

Write today to Dept. **P-512** for illustrated brochure "HOW MANY JOBS". See for yourself how GPL closed-circuit TV can help you save time, effort and money in your business.

GPL DIVISION
GENERAL PRECISION, INC.

Pleasantville, New York



Photocontrol . . .

. . . **is designed to overcome low and high-voltage lightning surge,** precipitation decay in photocells, atmospheric corrosion of integrating relay switches, and breakage. The Omega unit is said to incorporate the largest lightning arrester ever used in photocontrols for outdoor lighting. The CdS photocell is hermetically-sealed. Both 115 and 240-v models are available, with a 2¾-in. ID base to fit EEI-NEMA standard locking-type receptacles. It is rated at 1,800 w for incandescent lamps and 1,800-v amp on mercury vapor installations. **Precision Multiple Controls, Inc, Ridgewood, N. J.**

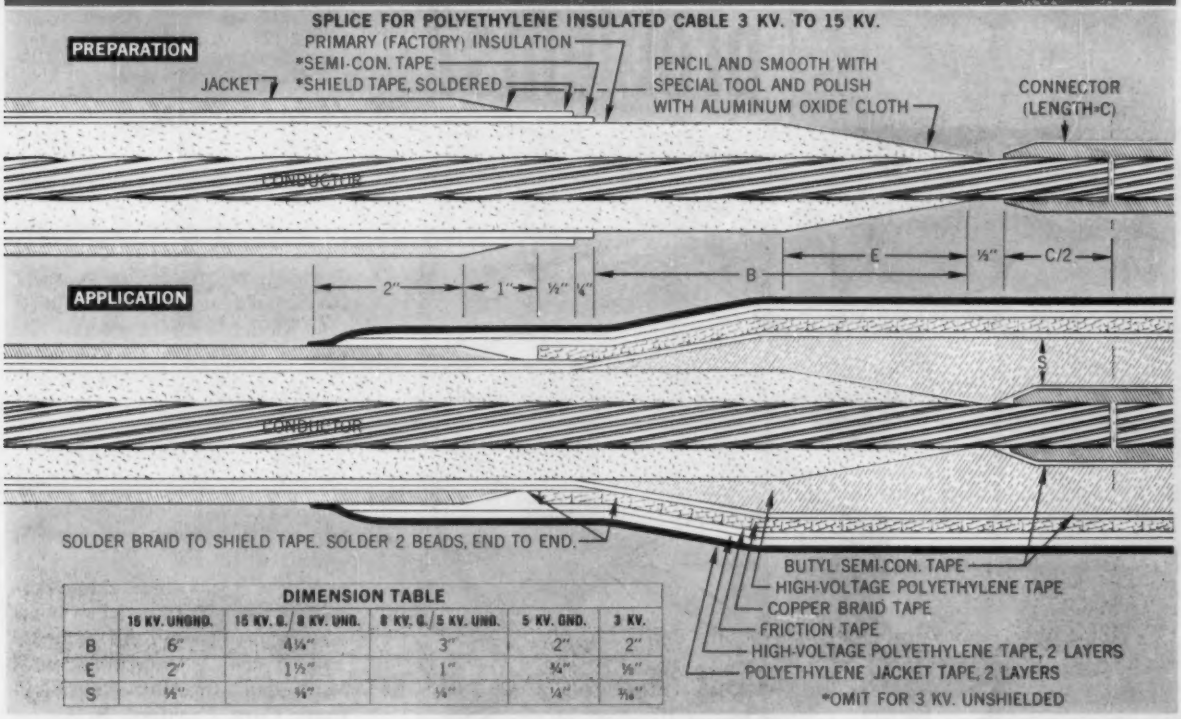
Battery Charger . . .

. . . **selenium-type, covers wide range of battery sizes.** Chargers are suitable for resistance and inductive loads for cyclic, floating and trickle charging of all storage batteries for switchgear control, signals and communications, and engine starting. Sufficient taps and rheostat are provided to allow fine adjustment of the charging rate on most applications. All designs are conservatively rated. Selenium stacks are said to have lowest forward aging rate; static-type converter components have no moving parts. Units will charge all types of batteries: lead-acid, nickel-alkaline or nickel-cadmium. **Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.**

(*More New Equipment, p* 92)

DU PONT

WIRE AND CABLE ROUND TABLE



DIMENSION TABLE

	15 KV. UNGND.	15 KV. G./8 KV. UNG.	8 KV. G./5 KV. UNG.	5 KV. GND.	3 KV.
B	6"	4¼"	3"	2"	2"
E	2"	1½"	1"	¾"	½"
S	½"	¼"	¼"	¼"	5/16"

Preparation diagram (top) shows the proportions to which the cable should be tailored, with dimensions as shown in the table for various voltages, grounded and ungrounded. Application diagram (bottom) illustrates soldering and successive applications of tapes to complete the splice. Dimensions shown are those demonstrated reliable in severe accelerated tests. Longitudinal dimensions are ordinarily increased 30% beyond these values on cables in service, as an extreme safety factor.

Du Pont study clarifies splicing of polyethylene-insulated high-voltage cables

An extensive Du Pont engineering study—conducted with the cooperation of major wire and cable producers and users—has helped eliminate the uncertainty concerning the relative merits of various methods of splicing polyethylene-insulated high-voltage cable. This trouble-producing problem of the past can be eliminated by simple techniques easily learned by any able electrician.

Since failures at splices constitute the majority of cable-system faults, the compatibility and the construction of the field-applied insulation at these points are as important as the selection of the cable's basic insulation.

Experiments involving accelerated life testing of cable insulated with Du Pont ALATHON polyethylene resin, under conditions which compressed normal cable life into a few months, produced the following conclusion: Tape-insulated splices are satisfactory for at least the normal expected life of the cable (measured in decades) —provided they are prepared with basically good proportions and with adequate application and workmanship as illustrated in the above cross-sectional drawings. Service experience to date corroborates the results. **For more information** about the preferred methods of splicing and termination of polyethylene-insulated cables . . . and specific help on your individual problem, write to: E. I. du Pont de Nemours & Co. (Inc.), Dept. EW12 Room 2507A, Nemours Building, Wilmington 98, Delaware. *In Canada:* Du Pont of Canada Limited, P.O. Box 660, Montreal, Quebec.

POLYCHEMICALS DEPARTMENT

DU PONT

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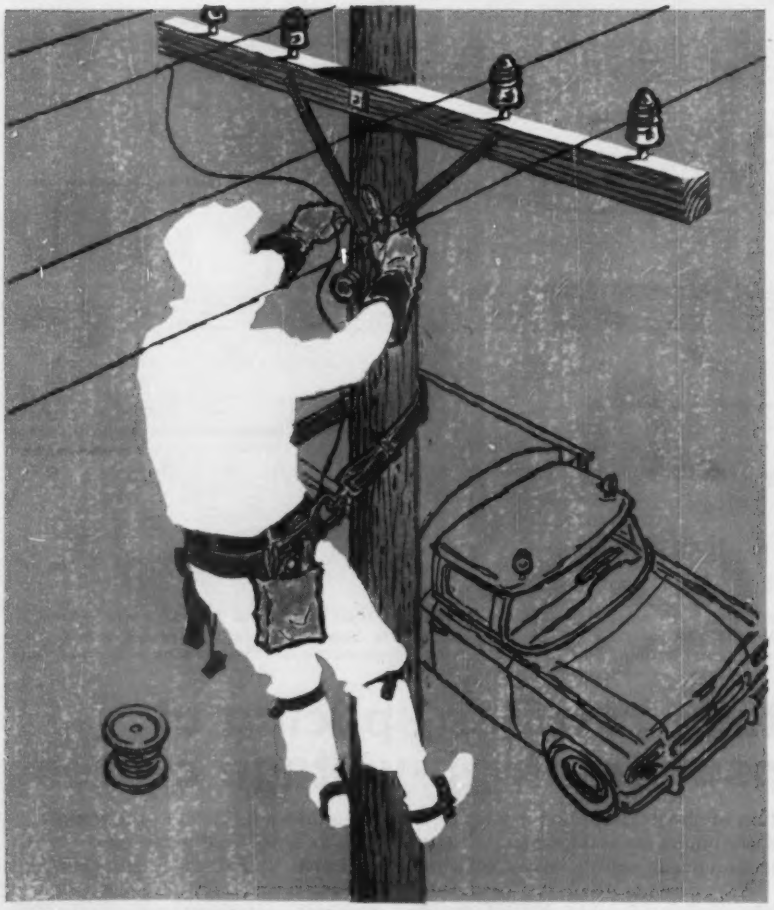
ALATHON® POLYETHYLENE RESINS | **RULAN®** FLAME-RETARDANT PLASTICS | **ZYTEL®** NYLON RESINS

personnel? --or personnel problems?



Next time you need line crews, consider the advantages of using a qualified contractor's facilities. You'll spare yourself the usual headaches of hiring and laying off, employee processing and training, absenteeism, etc. For special projects—or on a long range basis—the qualified contractor offers:

- the skills and equipment you need *when and where* you need them
- precise cost accounting
- reduced equipment overhead
- firm job completion dates and written performance guarantees

In addition, he can probably do the job at less cost to you. For names of NECA contractors, write

NECA

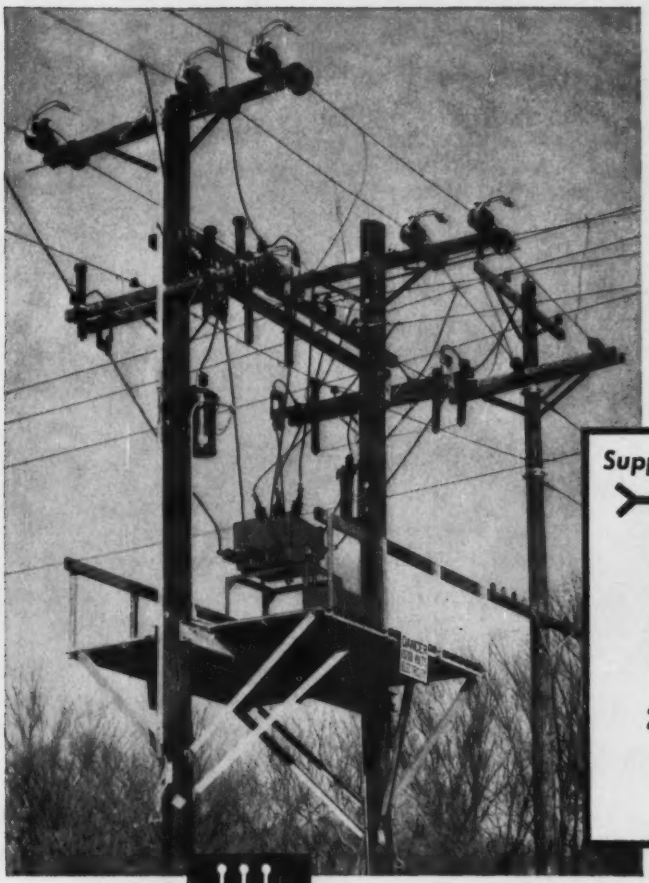
National Electrical Contractors Association, 610 Ring Building, Washington 6, D. C.

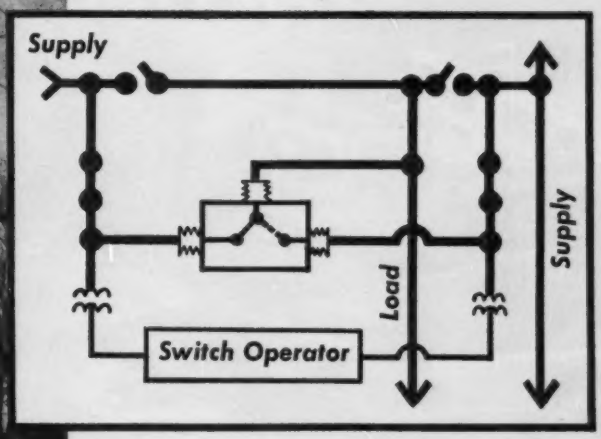
Network Protector Tester

. . . for full range 3,000-amp capacity, either 216 or 480 v, 3 phase, 60 cycle, can be used in the field or shop. The portable Model NTS-100 checks settings of relays, also the operation of the mechanism at normal and fault voltages. Unit has built-in instrumentation providing these 3-phase output sources: (1) 0 to 25 amp, 60 cycles, (0, 60 and 180-deg phase angle) infinitely adjustable by an autotransformer, and (2) 0 to 480 v for mechanical tests. All test functions are accomplished with panel switches —eliminating need for jumpers and other interconnections. **Multi-Amp Div, Multi-Amp Electronic Corp, Cranford, N. J.**

Fire Extinguisher . . .

. . . is as effective in amateurs' hands as when operated by experts, according to manufacturer. The portable carbon-dioxide unit comes in five models—which reportedly have been given the highest performance rating for extinguishers of their kind. Based on test fires in open containers using gasoline as fuel, ratings given the five models by Underwriters' Laboratories are 4BC, 8BC, 10BC, 12BC and 12BC (CQ). Capacities are 5, 10, 12, 15 and 20 lb of carbon dioxide, respectively, with total weights of 16, 34, 36, 42 and 57 lb. Actual UL tests are for areas 2½ times ratings given.
Chemetron Corp, 849 Michigan Ave, Chicago 11, Ill.





G&W Load-Break Oil Switches Are Excellent For Overhead Sectionalizing

All the well-known advantages of G&W Type RA Standardized Load-Break Oil Switches on underground systems are equally as effective on overhead lines. Complete system flexibility, reliability, immunity to weather, and automatic or manual operation are provided by G&W Type RA Switches in switching and sectionalizing loaded overhead secondary and primary circuits from 600 volts through 15 kv. Type RA switches are available with topmounted bushings or with cable entrances for aerial work as desired.

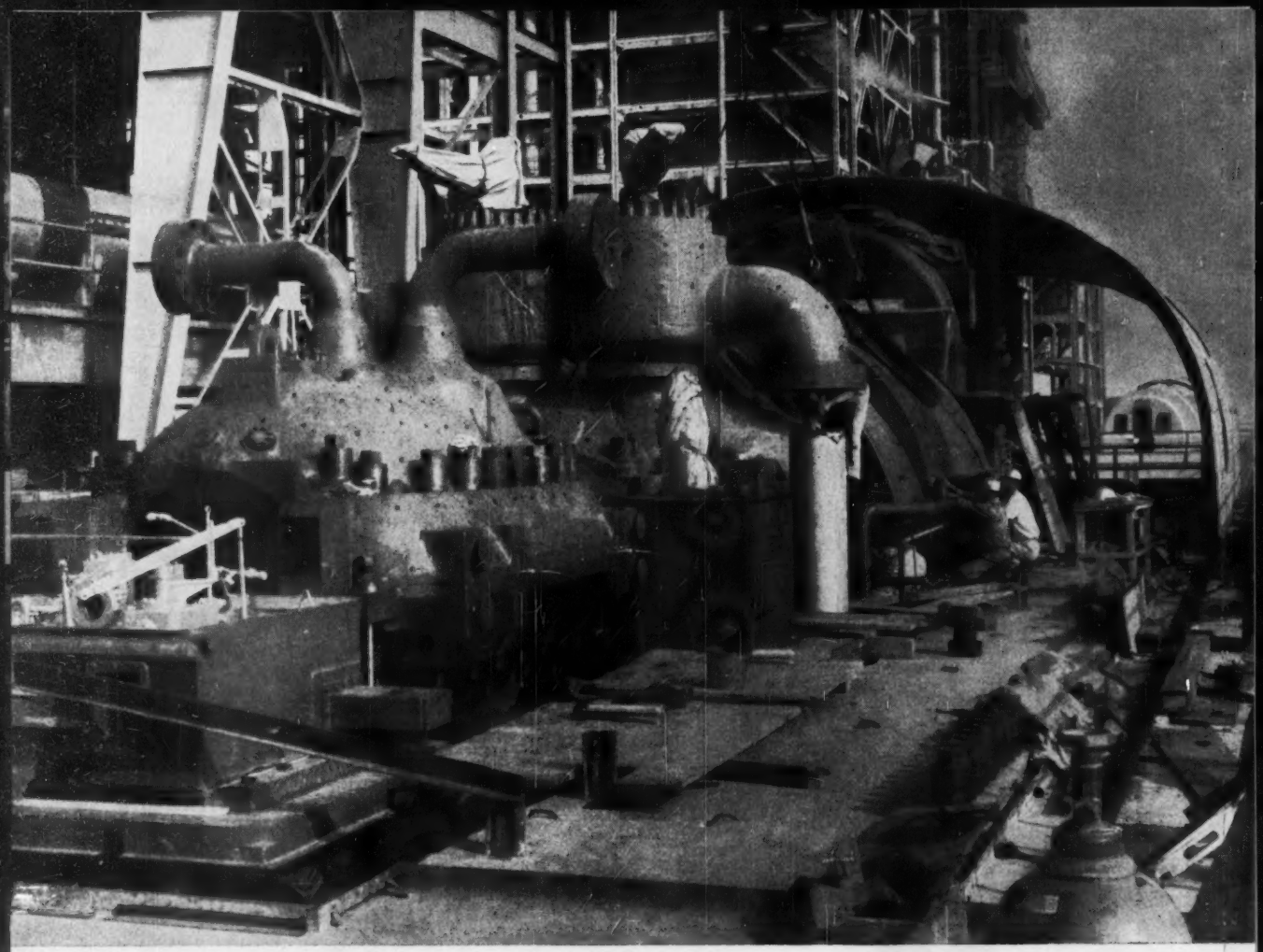
Illustration and diagram show how one utility provided automatic transfer for an important load using a G&W Type RA load-break oil switch. A G&W Model "F" automatic operating mechanism selects and throws the switch to preferred or auxiliary feeds as may be required so as to keep the load alive so long as either feed is energized. Two- and three-way Type RA switches are also available from G&W for direct pole mounting with groundlevel manual operating handle.

G&W Standardized Type RA Load-Break Oil Switches are conservatively rated at 400 amperes continuous duty and will break full load current. BIL and 60-cycle test voltages are equal to full power levels.

Write to G&W for further information on Type RA Standardized Load-Break Oil Switches or contact your nearest G&W representative.

G & W ELECTRIC SPECIALTY COMPANY
3500 WEST 127th STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFR. • POWERLITE DEVICES LTD. • TORONTO, MONTREAL & VANCOUVER
superior quality standards — inspired specialized design

D61-5



General Electric's experienced turbine-generator service teams have built an unsurpassed record on economical, on-time installations.

Economical, on-time turbine-generator installations don't "just happen"

Thorough planning plus know-how contribute to economical, on-time turbine-generator installations. General Electric's unparalleled record in this area is built on:

- pre-installation planning with purchasers to program the installation in terms of time, manpower, and scheduling requirements,
- know-how of G.E.'s turbine-generator service teams which provides on-the-job savings and helps keep the installation on schedule, and
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When you specify a General Electric turbine-generator you get a unit pre-engineered for economical, on-time installation—and you get personalized service for as long as that unit is on-the-line. 244-08

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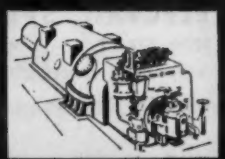
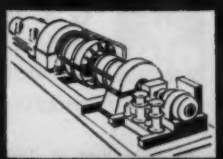
GENERAL ELECTRIC

General Electric Turbine-Generators Help Keep Power Costs Low

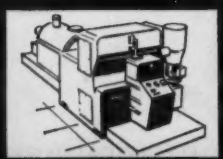
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles

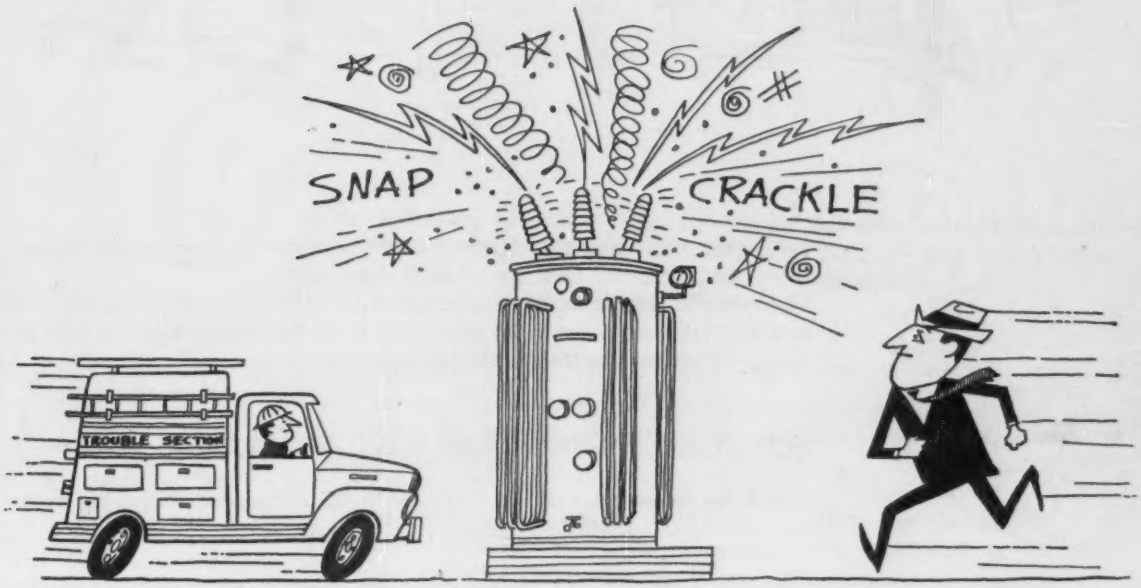


Mechanical drive steam turbines for auxiliaries

Electrical World

DECEMBER 4, 1961

Management Newsletter

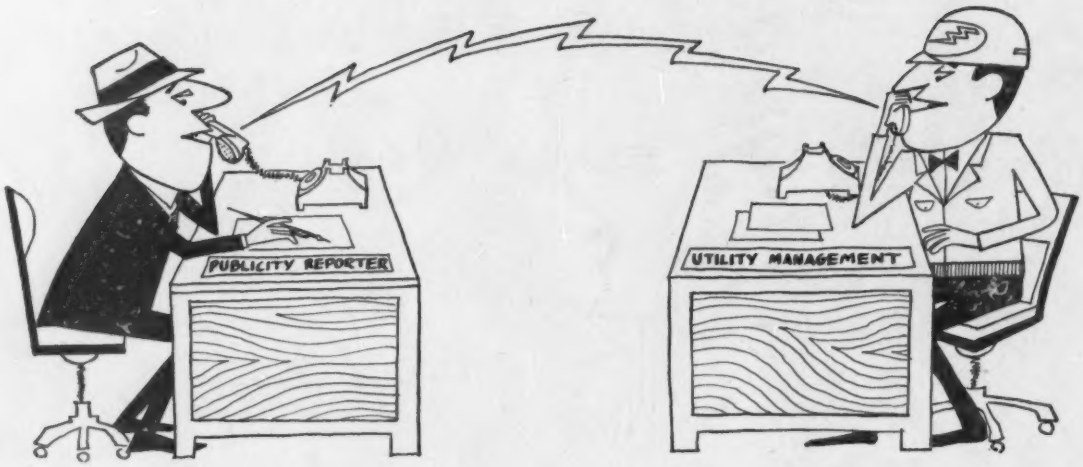


Inform the Public When Trouble Strikes

Adversity, like a mistake, is quite often an excellent teacher. This appears to be true in the case of the massive outage suffered by Cleveland Electric Illuminating Co last summer, for the fast and thorough action of the company's public relations and advertising staffs has become an electrical industry conversation piece.

More than 70% of CEI's 500,000-plus customers were without service beginning at 11:40 am (EW, Aug. 14, p 66), and within the first 15 min of the outage CEI's public relations people were telling customers what had happened.

Everyone in the electric utility business knows that the faceless, nebulous mass generally referred to as "the public" can turn into a many-headed monster when its electric supply is cut off. Working under the theory that this transformation is less likely to take place if the public knows what is going on, CEI management puts informing the public on a priority virtually equal to restoring service when an outage occurs. It takes this management commitment—well ahead of any emergencies—to provide the foundation for positive public relations action when



distribution substation circuit breakers start their minatory opening and closing.

Also, when big trouble comes, management itself (in CEI's case it was Ralph Besse, president) takes a position in the front rank of the information squad to help give prestige or authority to the company's explanation.

HOW PUBLIC RELATIONS MEN WENT INTO ACTION

Here is the documentary of how CEI's public information and advertising departments swung into action when trouble struck last August.

Robert H. Herrick, CEI's general supervisor of public relations, faced the first onslaught of newspaper, radio and television reporters. He was armed with very little information, but with assurances that an explanation would be forthcoming as soon as it could be ascertained. Since Herrick was formerly a Cleveland newspaperman himself, he is well versed in the care and feeding of reporters, and his assurances inspired confidence.

A CEI public relations staffer was immediately sent to the company's trouble section and load dispatching offices to create the operating end of an information pipeline. Through the pipeline, facts—as they were uncovered—were fed into headquarters where Besse and chief operating people began preparing the complete, factual statement that was to be the backbone of the company's public explanation.

By mid-afternoon, Besse was able to stand before a platoon of reporters and detail the events that caused the outage. The conference was held in the board of directors room where there were system maps, a blackboard, and other facilities to aid in giving a clear explanation of an extremely complex chain of events. Also, the room was sufficiently large to accommodate television cameras, and his message was recorded directly by them.

At dinner time the emphasis had turned almost completely to preparing television tape, additional filmed accounts, and interviews of Besse. These appeared on the city's three television stations during the night.

In the meantime, an unusual, carefully worded newspaper advertisement was prepared by Frank Derry's advertising section. It took the form of a letter to customers from the president and carried the following message:

Dear Customers:
Yesterday, the one thing we try hardest to guard against . . . happened. Electric power failed in most of the four-county area we serve in northeast Ohio.

This happened when a short circuit cut our system in half. An extreme overload resulted. Automatic equipment turned off the rest of our power sources to protect the system against lasting damage.

We couldn't just throw a switch to get it all back on, though. We had to take it one step at a time—a delicate, complex job. Even so, our employees had the power back on in near record time.

While the lights were out, however, the Greater Clevelanders were wonderfully patient. Housewives, storekeepers, office workers, factory hands—they all must have known we were doing our best, working as fast as possible to restore service.

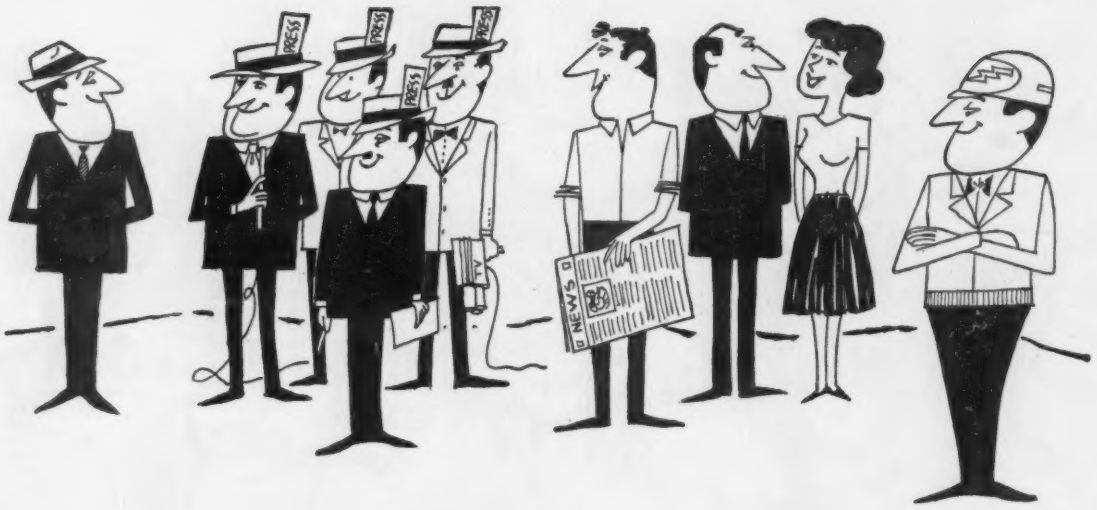
The newspaper, TV, and radio folks were right on the job with us, reporting the facts as fast as we uncovered them. Greater Clevelanders were never more than a step behind us in learning what was happening.

We're sincerely sorry for the inconvenience yesterday. This particular type of trouble never happened before. We will do our best to see that it never happens again.

Thanks to all of you.

Ralph M. Besse, President

The ad was prepared and rushed to the newspapers in time to make the early Satur-



day morning newspapers— and all other editions of the newspapers of the day.

INTERNAL TEAMWORK AIDS FAST REPORTING

What does it take to gear a utility public relations unit for the caliber of reporting demonstrated by CEI?

Looking at the CEI organization, one finds PR representation at the executive level. In this case it is Lee C. Howley, vice president and general counsel. Reporting to him is Robert H. Bridges, manager of the public information department. Under Bridges is Herrick, general supervisor of the public relations section, and Derry, general supervisor of the advertising section.

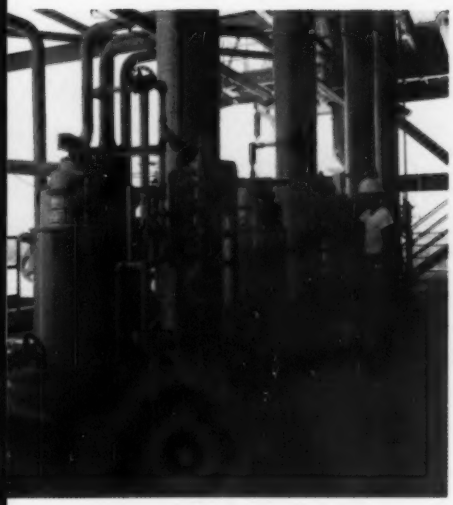
Five public information department men are on a rotating list to receive the first call when trouble breaks out. Each man spends a week in the "first call' position, then goes to the bottom of the list and starts to move back up. Company telephone operators and the trouble section have the list for the current month ready to use at any moment during the day or night. When he is called, the first call man goes to the trouble section, begins gathering information, and sets up a special telephone line to use for **(1)** relaying information to the PR office, or **(2)** to call newspapers, radio stations, and television stations directly.

Herrick points out three features of the communications setup that are significant. First, two reserved, unlisted telephone lines come into the company switchboard. One is solely for the use of the working press, radio and TV reporters. This one comes into the company switchboard and stops there. The operator takes the name of the caller and relays it to the responsible PR man on duty. The other line is for the use of the PR people in reaching the trouble section, and rings directly into the trouble section. Besides these two lines, Herrick has an unlisted telephone in his own home specifically for emergency periods.

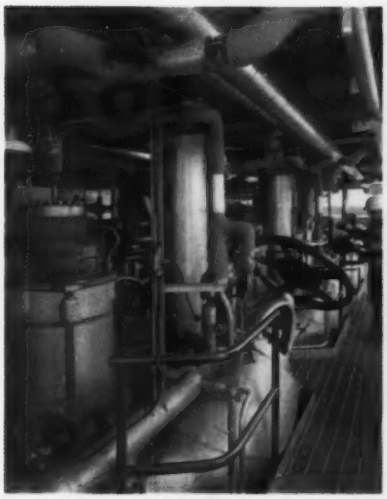
The August incident proved that the organization is effective. Explaining why it is effective could get complicated, but the two principle ingredients of its effectiveness are, **(1)** a feeling of teamwork on the part of the staff, and **(2)** the management commitment, mentioned before, that puts the importance of informing the public on a high priority when trouble breaks out.

MAINTENANCE?
FORGET IT!

Westinghouse canned motor pumps give you more than zero leakage. Operating people are finding these pumps truly economical in controlled circulation boiler systems. No seal maintenance or external bearing lubrication is necessary. They can withstand full temperature and pressure at hot standby conditions. No adjustments are necessary. They can be started and stopped at any time at full pressure and temperature. It will pay *you* to investigate the economics of these unique pumps. Call or write for complete engineering and performance data.



Florida Power & Light Company has eight of these Westinghouse canned pumps in operation at the Port Everglades Station.



Three canned motor pumps are installed in the H. B. Robinson Station of the Carolina Power & Light Company.

Successful operation is reported for these three Westinghouse pumps at the Yorktown Station of Virginia Electric Power Company.

Modern production and testing equipment make Westinghouse Atomic Equipment Department the most complete facility of its type in the world. Controlled circulation boiler pumps are available in many head and flow combinations for high temperature, high pressure applications.

Westinghouse

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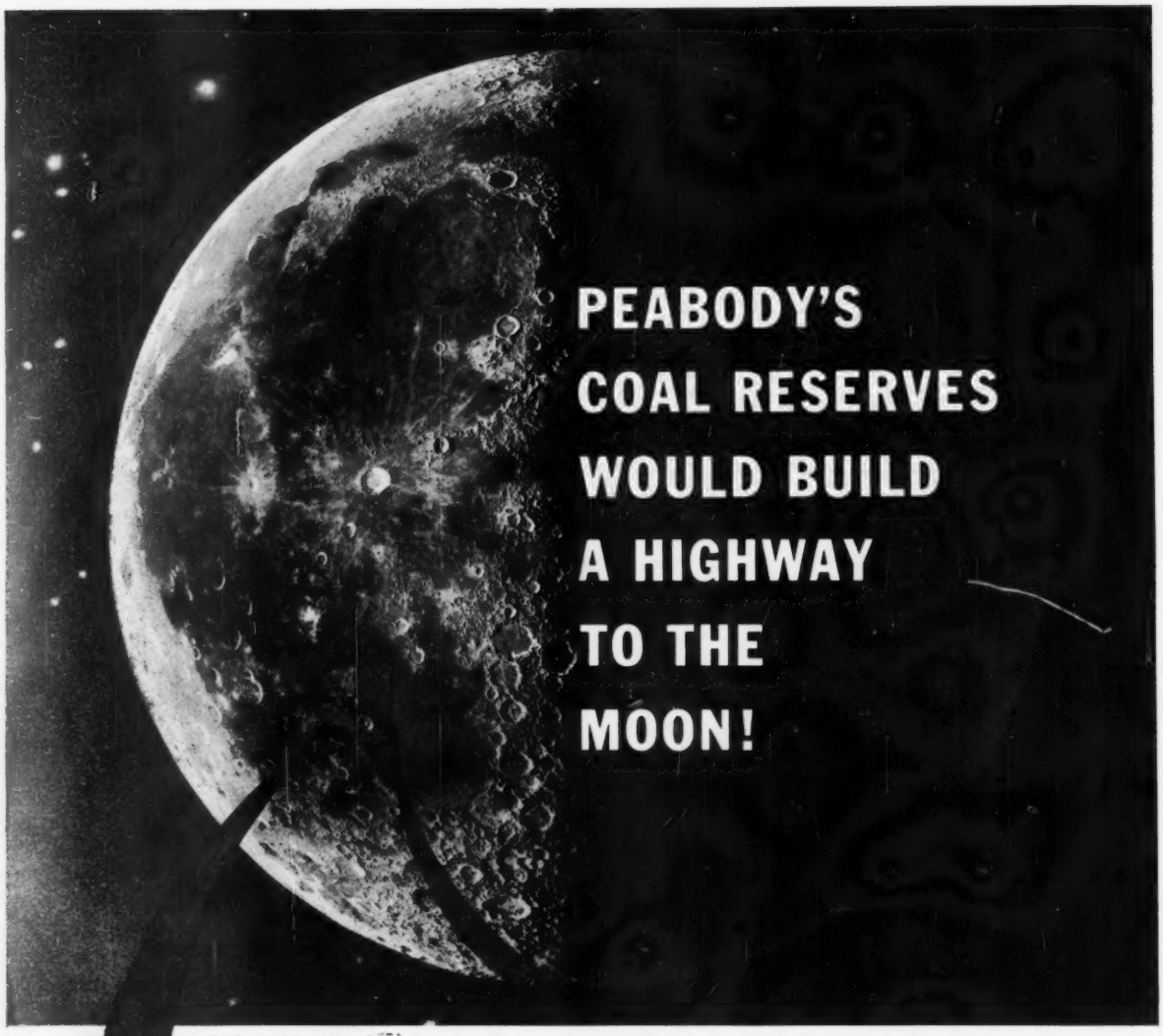

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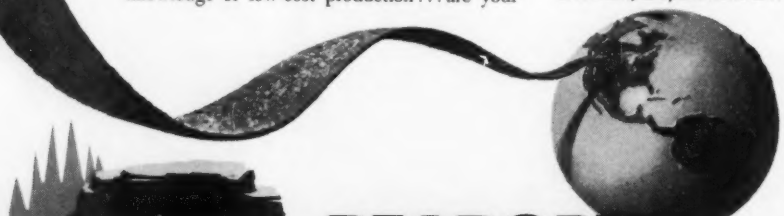
Peabody's Coal Reserves are large enough to build a highway to the moon . . . 40 feet wide and 1 foot thick. They could light and power Chicago for 200 years or power all of New York City's television sets for 1,644 years. That is a *lot* of coal . . . it is a dependable source for you. These vast reserves . . . strategically located near the nation's inland waterways . . . plus Peabody's knowledge of low-cost production . . . are your assurance of an economical supply of coal for years to come. And at Peabody mines, coal is tailor-made to get maximum efficiency from your burning equipment. Your nearest Peabody representative can give you complete details.

Learn more about the location of Peabody's 25 modern mines and river dock loading facilities. Write Industrial Development Division, Department EW.



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Utility-Industrial Teamwork Needed (*Continued from p 74*)

in of accelerating motors and risks dropout of running motors; (3) the danger of instability between industrial motors and utility generators during a fault; and (4) the selection and setting of relays. The last situation, he said, calls upon industrial engineers to evaluate motor protection vs possible interruptions.

Cable Troubles Corrected

Distribution circuits at Shell Oil Co's Houston refinery today are being installed in messenger-supported aerial cable, except where ducts are available, said L. G. Tuggle. PVC-jacketed, interlocking-armored cable is used at 12 kv but three single-conductor cables are lashed to the messenger for 2.3-kv and 600-v operation. This program was adopted, he said, because the aerial cable is cheaper to install than cable in ducts, can often be supported from existing structures, affords desirable flexibility and higher current-carrying capacity, and permits cheap and speedy repair of faults.

Meanwhile, intensive investigation and tests have corrected serious troubles initially experienced with lead-paper cable first installed in underground concrete ducts in 1945-6, Tuggle said. This system was adopted at the time, he said, because it provided protection against storms, mechanical damage and fire; enhanced the plant's appearance; and promoted safety. But corrosion soon caused a costly series of faults which was overcome by (1) removing the bare, copper, ground wire or isolating it from lead sheaths, (2) installing magnesium-anode ground beds and some rectifiers for cathodic protection, (3) flushing ducts and manholes periodically with treated water, and (4) bonding all cable sheaths to cathodically-protected pipelines. Since this program was completed in 1950, failures have been few even though 99% of the original non-jacketed cable remains in service. But all new cable pulled in ducts will have a protective jacket, he said.

"Underground residential distribution is here to stay and growing in popularity with customers and developers alike," said D. S. Ware, Dallas Power & Light Co. The company offers it to customers who agree to limit an area's service to 3-wire 120/240-v service, charging customer or developer for the excess over the cost of standard overhead service.

Early coordination with other utilities and the paving contractor is important, Ware said, and usually best secured through the engineer who prepares the street and lot plans. Electric service is installed after sewers and water lines have been buried. It has primary loops of neoprene-jacketed, concentric cable with copper neutral over a butyl-insulated, No. 2, stranded, copper conductor for a 15-kv solid-grounded system. The primary terminates on 200-amp disconnects in the primary compartments of pad-mounted distribution transformers installed at rear property lines. The secondary compartments include up to four meters for customers served from the unit, he said.

Polyethylene Pares Cable Cost

Primary cable cost for direct-burial can be pared by using polyethlene insulation shielded by an extruded semi-conducting jacket and an alloy-coated, round neutral wire spiraled concentrically over all, said E. J. Merrell, Phelps Dodge Copper Products Corp. This cable can also be produced with a plastic conduit for locations where reconductoring is anticipated. But today's trend in cable is the seamless aluminum sheath over butyl insulation, said Merrell. This development has restrained the use of polyethylene for 15 kv and below, he said, and oil-impregnated paper remains predominant for higher voltages.

Anti-corrosive jackets of high-molecular-weight polyethylene as well as neoprene are gaining acceptance for protection of sheaths against galvanic and concentrated-cell corrosion, particularly in filled earth, or where de-icing salts are applied to streets. It also helps to prevent arc burning during ground faults, Merrell said. Aluminum sheaths require such correction when placed underground, but may be bare for aerial installation except where triplexed "singles" are lashed together or the atmosphere is particularly corrosive.

Distribution at 13.2/23 kv has proved economical for the Carolina Power & Light system and feasible even in towns and cities, said John W. Hunter. It requires fewer circuits, making for less hazardous and more sightly pole lines, and its performance exceeds expectations. Construction cost is almost the same as 7.2/12.5 kv and suitable equipment has been made available by numerous manufacturers, he reported.

Urges Distribution Advances

"Distribution—and the engineers who design and build it—probably face more pressure than any other segment of the industry," said L. M. Olmsted, Electrical World. "Distribution engineers face the job of building in this decade as much plant capacity as the industry has in service today. They must communicate effectively and often with their managements and colleagues, and promptly pass along to others their contributions to the art. They must avail themselves of computers, research and development, published material, and every other source of information that will help them build better for tomorrow's needs."

Distribution still has problems to challenge the analytical, planning, and design skills of engineers and yet, because it differs so radically from the design and construction of bulk power facilities, distribution engineering has too often gravitated to an inferior position, observed Olmsted. He cited a mid-western utility which has successfully reversed this trend by specialized training and experienced a sharp upturn in esprit de corps which, he suggested, could have a beneficial effect upon ability to attract young engineers.

Utilities, he said, are criticized for failing to give young engineers a proper opportunity to advance, and for paying unfavorably low salaries. On the latter point, he commented:

"Money is not the sole criterion of desirable employment. But the lack of income to live on the same level as classmates in other industries is hardly conducive to quality performance. Alert managements avoid this irritation, and the contributions of their engineers to advancement of the art attest to the wisdom of their policies."

Trade Groups Show Electric Heating Interest

National Coal Policy Conference regional meeting draws 165 people to hear electric heating message

Enthusiasm ran high among the 165 persons from 15 states who attended the Western Regional Conference on Electric Home Heating sponsored by the National Coal Policy Conference in Kansas City, Mo. This second meeting was an extension of the first conference held in Washington, D. C. on February 17, (EW, March 13, p 79-80). Present indications are that this regional approach will be extended to other sections of the country.

In attendance were representatives of electric utilities, railroads, electrical contractors, realtors, coal firms, unions, architects, bankers, building contractors, small home builders, electric associations, manufacturers, plasterers and lathers.

Joseph E. Moody, president of the NCPC stated the purpose of the conference: "We determined that the best way we could carry on the campaign was to get out of the nation's capital and meet and talk with the people who are actually building electrically heated homes, the people who are supplying and installing the equipment, the people who put in the proper insulation. And, of course, the people who are supplying the electricity itself."

But what Moody said he was really there to talk about was "the bright future we all have in the development of electric home heating, in this new concept of the complete comfort home." However, what should this modern method of heating homes be called? Moody asked. "What term can all our industries agree on that is both descriptive and, at the same time, catchy enough so the public will remember it?" He pointed out that while "electric home heating," "comfort heating" and "convenience heating" tell part of the story, they lack one element—none mention coal, "The fuel which is used for generating two-thirds of the electric energy produced by steam electric utilities in the United States."

"Electri-COAL" home heating was suggested by Moody.

He then called for an annual production of at least 500 million tons of coal. "It is a growth we can achieve, and one of the most promising ways of doing so is developing the electric home heating market," he said.

New Approach Cited

An entirely new approach to selling electric home heating is needed, according to Michael F. Widman Jr, assistant to the president, and research and marketing department director of the United Mine Workers of America. What's needed is increased effort in the field of customer satisfaction ("Somewhere along the line our nation has lost the idea that the customer is always right"), a return to the concept of customer satisfaction as the most valued sales tool at command. "And what better place for us to make our contribution in this regard than in the field of electric heat?" Widman asked.

He also pointed out that the UMWA is interested in promoting the acceptance of electric home heating because by doing so the coal industry is back in the home heating business. The average American home uses about 1.5 tons of coal equivalent electricity, Widman pointed out, but when the customer decides to heat his home electrically his usage jumps to ten or more tons of coal each year. "We have assisted the electric utilities on many occasions when such help would aid the acceptance of 'coal by wire,'" he said. "Very often we are able to succed together when we would surely have failed seperately."

Widman also pointed out that now the electric utility industry can do to the oil and gas industries as oil and gas has done to coal—i.e. substitute an electric conversion unit for the present oil and gas-fired units in existing homes. "There are over 32 million homes currently being heated with gas. "If all of the 32 million homes . . . were to convert to electric heat, this would mean a potential for 'coal by wire' of some 320 million tons, assuming that each home would use the equivalent of ten tons of electricity."

The electrical contractor is in an ideal position to sell electric heat because he can sell it, design it, furnish the equipment, install it, maintain and service it, and give the customer a guarantee. As a group, the electrical contractor is vitally interested in selling and installing electric heat. These were the thoughts of Reuben Sell, Sell Electric Co, Mission, Kan.

Electrical contractors are "really getting excited about electric heat and we're going to do something about it," Sell said.

To back this up, he announced a new sales concept developed by the National Electrical Contractors Assn, "CBG Air Comfort Systems." This features the complete package sale of an air comfort system that's certified, bonded and guaranteed.

Under this new system, it will be guaranteed for "three full years," not just for the equipment but the operating cost as well, Sell said. All contractors will be certified as having completed the NECA Certified Electric Heat Course.

Commonwealth Edison's Robert C. Geyer pointed out that building and trade union people were pushers behind the central city redevelopment in Chicago, Marina City. He emphasized the rebuilding of the central city downtown area as having great market potential for electric heat.

The success of the conference was probably best stated by Kansas Power & Light Co's Neil Thompson who said, "The telling about all of our allies in the business was significant to me. It appears that the coal industry will get us into the heating business whether we want to or not."

(*More Selling on page* 108)

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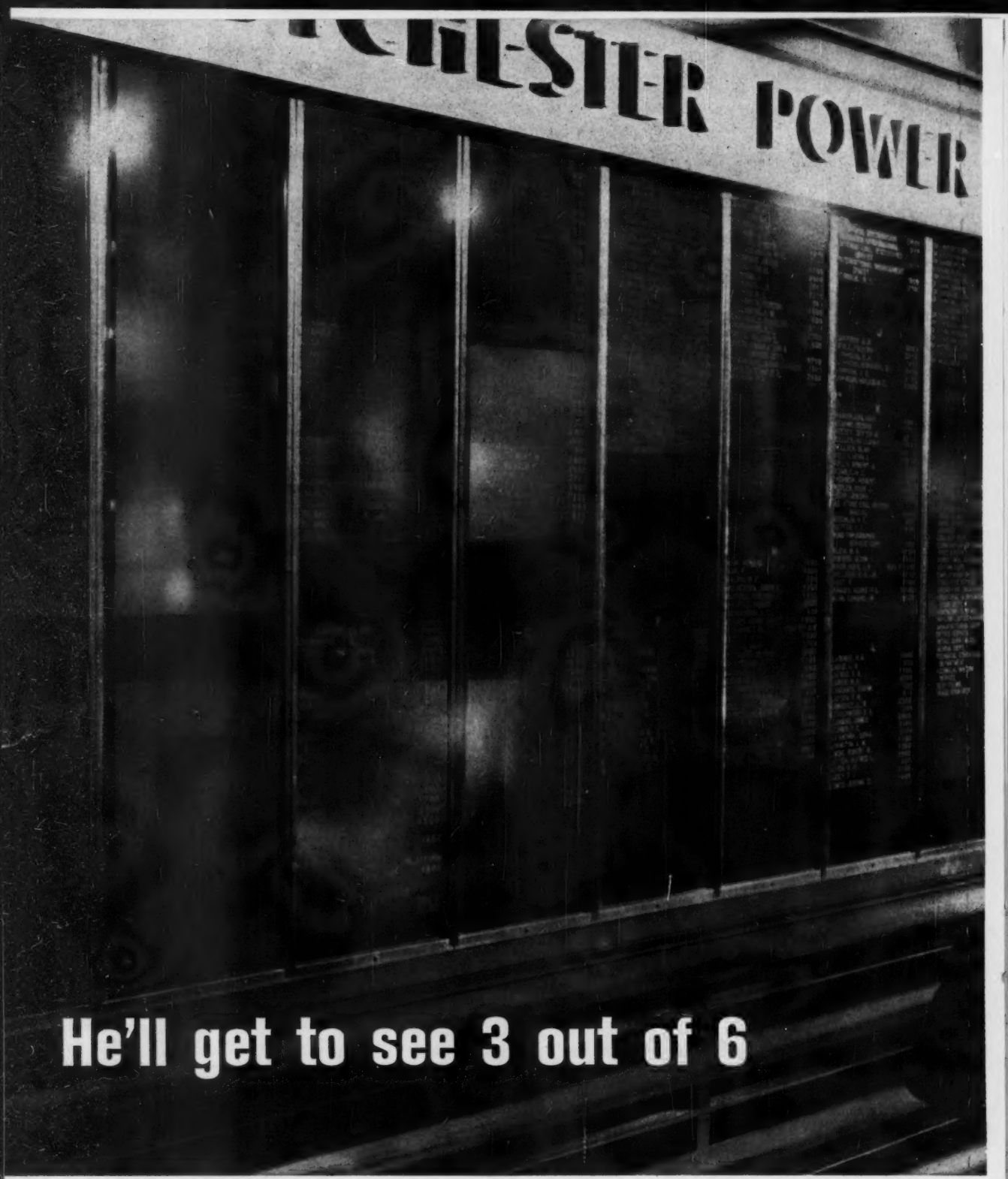

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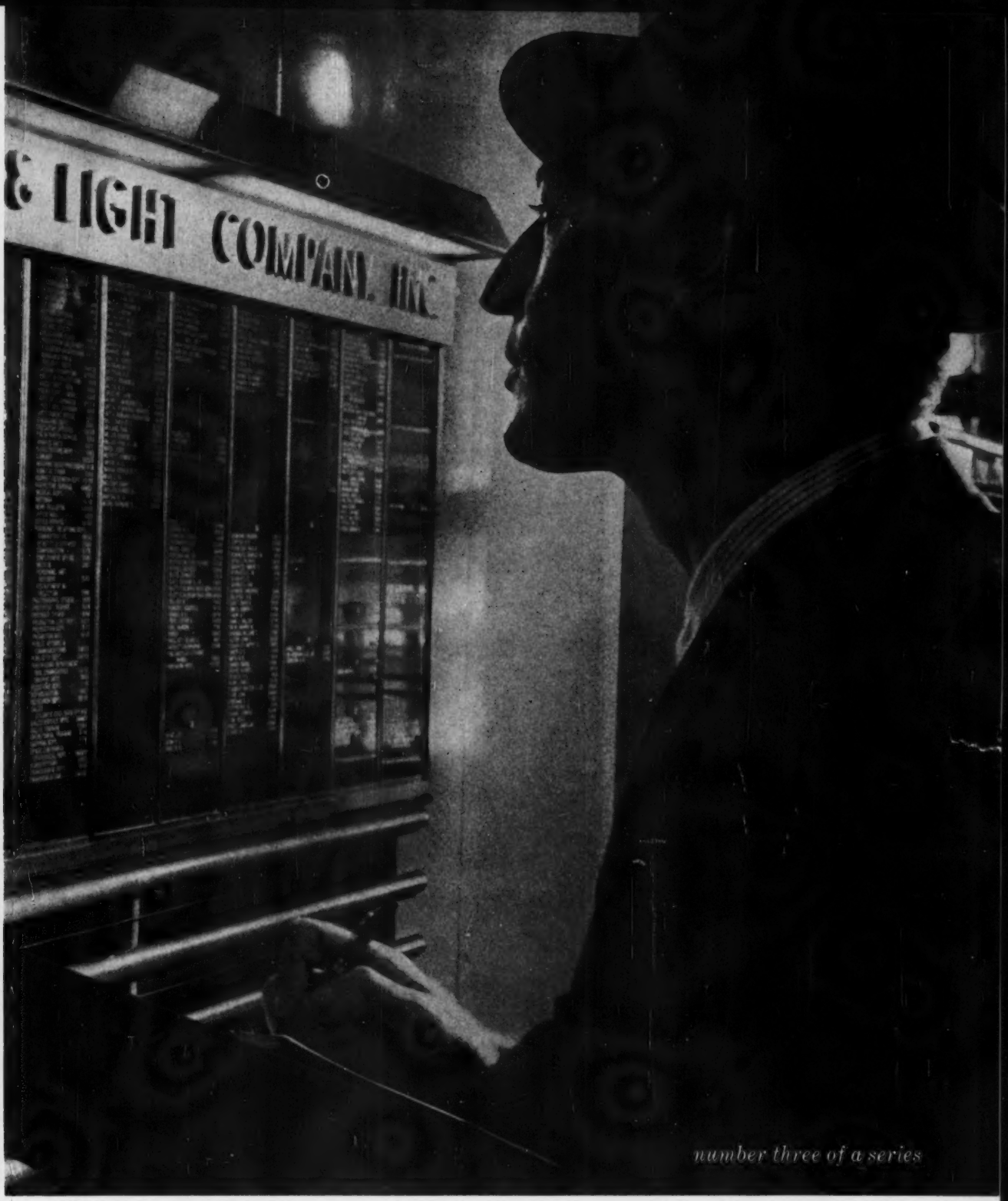


Electric utility men, consulting engineers, contractors, and big industrial buyers of electrical equipment, for example, depend on Electrical World for business information. Turn-over of this audience is among the very lowest*, readership** and quality among the highest. Manufacturers' own studies show Electrical World to be the preferred business reading of the men who buy.

To make your salesmen *most* effective, back them with sales communication in print, in Electrical World!

a McGraw-Hill Businesspaper

Electrical World

the electrical industry's weekly magazine

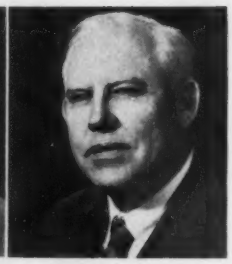
Virginia E&P Makes Clark a Vice President

CLARK

Virginia Electric & Power Co has elected Arthur L. Clark to succeed H. Atwood Hitch, who retired as a vice president.

Clark joined VEPCo in 1928. He became district accountant at Suffolk in 1936, and came to Richmond as supervisor of general accounting and payroll in 1937. In 1945 he was appointed chief accountant, and in 1951 became auditing and procedures director. He was named assistant treasurer in 1953 and personnel director in 1956. Clark has been serving as personnel manager for the past three years.

MARRS



WALLACE

Marrs, Wallace Given VP Positions

Texas Power & Light Co's secretary and treasurer, George R. Marrs, has been promoted to the position of vice president and secretary. The utility also appointed P. G. Wallace to become vice president in charge of engineering.

A. J. Kleinman was selected to succeed Marrs as Texas Power & Light's treasurer and to serve also as assistant secretary.

KIMBALL

Vice Presidency Goes to Kimball

William H. Kimball has been elected to the position of vice president of Central Maine Power Co. He will continue as comptroller, the post he has held since 1946.

Two Services Components Established at General Electric

SMITH

DAY

General Electric Co has established two new corporate services components: marketing and public relations services, and management development and employee relations services.

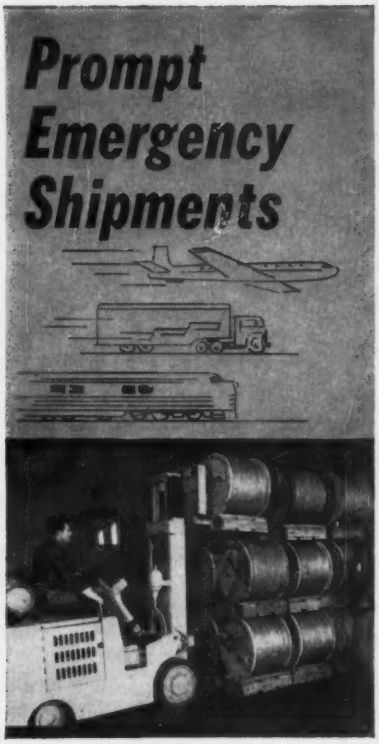
J. Stanford Smith was placed in charge of marketing and public relations services and elected a vice president. Virgil B. Day, formerly vice president in charge of relations services, was chosen to head management development and employee relations services.

Smith becomes a member, and Day continues as a member, of the General Electric executive office.

Prior to his apointment in 1958 as general manager of the outdoor lighting department, Hendersonville, N. C., Smith was manager of public and employee relations communications.

Day has been with General Electric since 1947, when he joined as counsel to the employee relations division. Two years later he was assistant manager of the division. He moved up through the ranks and, last August, was elected a vice president and named to head relations services.

(*More News About People on page* 107)



Crapo
GALVANIZED
STEEL STRAND

When in need of guy or messenger strand during an emergency, be sure to contact the nearest distributor of **Crapo** Galvanized Strand! Substantial stocks are maintained at strategic distributing points throughout the country ready for immediate delivery. Back of these stocks are our own extensive mill stocks of finished strand, and strand in process. If your jobber does not have all of your requirements, he knows he can depend upon us for immediate shipment of popular sizes and grades by air, truck or rail.

You, in turn, can rely upon **Crapo** Galvanized Steel Strand, at all times, to give you the utmost in performance at reasonable cost.

Crapo Galvanized Steel Strand is manufactured in all standard sizes and grades and in three weights of coating: Class A, B and C.

Phone the distributor of **Crapo** Galvanized Steel Strand near you the next time you need strand.

INDIANA
Steel & Wire Co., Inc.
Muncie, Indiana

Crescent Tool Appoints Bailey to Be President

Alaric R. Bailey has been elected president of Crescent Tool Co of Jamestown, N. Y. Bailey, vice president of Rockwell Manufacturing Co since 1958 and general manager of its automatic voting machine corporation division, will also serve as a vice president of Crescent Niagara Corp of Buffalo, Crescent Tool's parent company.

BAILEY

VP-Marketing Director Post Goes to Hochanadel

Paul J. Hochanadel has become vice president-director of marketing for Royal Electric Corp, a subsidiary of International Telephone & Telegraph Corp. Hochanadel had been with General Electric Co for 14 years. He served that company in various marketing capacities.

HOCHANADEL

Walker Is Ad Manager for McGraw-Edison Division

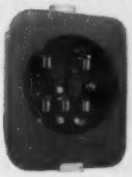
Charles V. Walker has been appointed advertising manager of Pennsylvania Transformer division of McGraw - Edison Co. He joined Pennsylvania Transformer's advertising department in 1953, and previously was associated with Downing Industrial Advertising, Inc, and W. S. Hill Co, Pittsburgh agencies. Walker is a graduate from the University of Pittsburgh.

WALKER

(*More News About People, p* 108)

look to...

SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON 1, OHIO
A Subsidiary of
The Union Metal Manufacturing Co.



Drawn Ringless Socket

Write for a free Catalog outlining types and sizes of meter socket equipment, test switches, test blocks, reactiformers and enclosures.

Wishart Selected to Fill Chairman's Post

Minneapolis-Honeywell chooses Binger to be president, Keating for executive vice presidency

WISHART

BINGER

KEATING

Paul B. Wishart, president of Minneapolis-Honeywell Regulator Co since 1953, has been elected chairman of the board and chief executive officer.

James H. Binger, a vice president and director, was elected to succeed Wishart as president.

Also, Minneapolis-Honeywell created a new executive vice presidency and elected Stephen F. Keating to the position.

Wishart succeeded Harold W. Sweatt, who was named chairman of the finance committee.

Wishart's career with the company spans 20 years. He held key administrative and production positions during World War II and later, as vice president of manufacturing, directed the company's Minneapolis production operations throughout the entire postwar period.

In 1952, Wishart was appointed to a vice presidency and made general manager. A year later he was elected president.

Binger, an executive with Minneapolis-Honeywell for 15 years, was elected a vice president in 1952 and a director in 1959. Since 1956, he has had responsibility for management of the company's temperature controls group.

Keating heads the company's military products group. He has been with Minneapolis-Honeywell since 1948, as a vice president since 1956 and a director for the past year.

Selling (*Continued from page* 102)

An all-electric apartment development of 6,750 "own-your-own apartments" for people 52 years old and up will be opened for occupancy in Seal Beach, Calif., this month. Revolutionary features will be cost of complete medical care and drugs, short of hospitalization, included in monthly apartment payments; no steps or stairs, only ramps and grades; rolled street curbs; and electrical outlets placed to make bending unnecessary. Over 33,000 appliances and other heating and electrical devices will be included . . . **An "area" lighting marketing program** with significant expansion of its product line for such outdoor off-street/non-residential applications has been developed by General Electric Co. Two mercury units and two fixtures using "Quartzline lamps" have been added to the company's floodlight line, and three-post mounted designs, one for incandescent only, one for mercury and incandescent and one for fluorescent have been developed. A "quick-response" photoelectric control has also been developed. The mercury units resemble small television sets in appearance, while the incandescent post lamps look like oriental "coolie hats." An area lighting guide, GEA-7223, is available . . . **Three programs** designed to speed up and improve repair of appliances have been inaugurated by the major appliance division, Westinghouse Electric Corp. Under these programs servicemen can complete most calls in one stop through scientific loading of service trucks combined with an expanded training program; radio-dispatched trucks can answer most calls within 24 hours; delivery time of rarely needed or unusual parts from the factory is reduced to as little as 48 hours. Radio control and dispatching of service trucks in most metropolitan areas will assure nearly 50% of the population getting a serviceman within 24 hours after call, Westinghouse said. Also the manufacturer will use the nationwide network of Western Union's "Operator 25" system to supply customers with names of authorized major appliance and television service locations . . . **Target date** for getting out of the major electric appliance sales business by Consumers Public Power District has been set for April 1, 1962. State Law LB-578 passed by Nebraska state legislature made it mandatory for public power agencies to quit selling appliances with retail value of more than $50.00, (EW, Aug. 14, p 111-112). CPPD General Manager R. L. Schact said the utility wants to make necessary personnel adjustments, put load promotion program into effect immediately, continue to service appliances until other facilities are available to CPPD customers . . . **National Industrial** Electric Heating Conference has been set for Feb 6-8, 1962 at the Netherland Hilton Hotel, Cincinnati. Two of the seven sessions will be devoted to industrial electric comfort heating; remaining five cover process heating.

TVA Guards Consumers

(*Continued from page* 73)

ing by TVA-area systems to facilitate these studies.

John H. Rixse, assistant chief engineer, Rural Electrification Administration, said that seven conferences on polls have been sponsored at universities and that another is planned for the University of Tennessee. The latter will be the engineering-management type and will teach this group what is needed, especially with regard to treated wood. It will also seek to impress on suppliers the interest of the cooperatives in better-quality poles.

The conference is expected to develop local talent, available to the university for an inspection and maintenance workshop which will follow the wood-pole conference. The workshop will be for men doing or supervising the inspection and treatment of standing poles. Run like a classroom, it will have a laboratory feature for giving the men an opportunity actually to inspect and treat defective poles.

Urges Care in Line Design

Creep is a more important factor in the design and construction of lines with today's larger conductors and longer spans, said G. E. Chase, Olin Conductors. In line design, it is of growing importance to allow for final sags and clearances.

Factors to observe, he said, are:

1. Calculated ruling span from actual span lengths

2. Temperature readings during stringing and sagging.

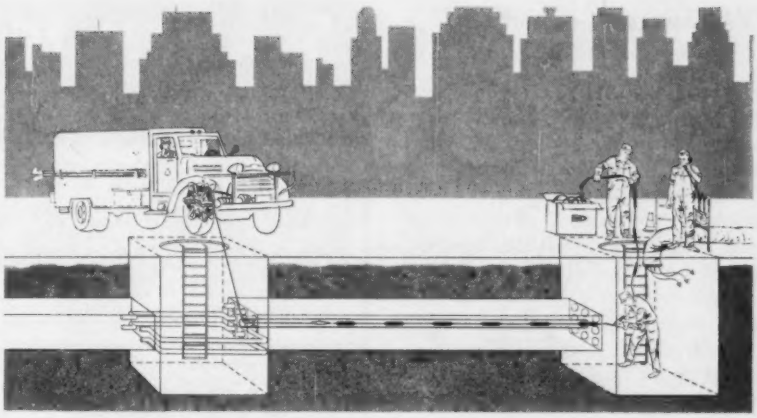
3. Checking guys and structures for movement or slippage, after conductors are sagged and dead-ended.

Compare the costs of the job with different conductors but don't buy features you don't need, urged C. M. Fredrickson, technical manager, also Olin Conductors.

Speaking on conductor characteristics, Fredrickson said that the recently available Alumoweld conductor appears to offer better core protection than ACSR and has less susceptibility to corrosion. All-aluminum conductor sags more than the composite conductors, but offers potential economies when the sags can be tolerated.

Rentals for joint-use poles in contracts between TVA coopera-

(*Continued on page* 110)



CABLE FAILURES REDUCED OVER 96% WITH
DURCO IMPRESSED CURRENT ANODES

In one congested metropolitan area, the number of lead covered cable failures dropped from over 50 per year to 2 after the application of impressed current cathodic protection. These two failures resulted from deeply pitted areas on the cable sheath prior to application of the negative potential.

Durco impressed current anodes have proved far superior to other materials. Want more detailed information on the Durco Type G anode for Duct Applications?

Write for Bulletin DA/7.

THE DURIRON COMPANY, INC., DAYTON, OHIO | DURCO

You Can Depend on
MINERALLAC®
for a complete variety of Field-Tested
Insulating and Cable-Pulling
COMPOUNDS

Available in ½ Gallon, 1 Gallon, 2 Gallon, 5 Gallon Containers and 50 Gallon Drums

Minerallac has served the Electrical Industry with the finest and most dependable assortment of Insulating Compounds available, for over 67 years. Widely used, with complete satisfaction, for Cable Joints, Potheads and Terminal Bells. Eight types, for various voltage, temperature and climatic conditions. Dense, viscous and fluid consistencies. Safe, economical—outranks all others in quality.

Order from Your Electrical Wholesaler
LITERATURE OR SAMPLE ON REQUEST

MINERALLAC *Electric* COMPANY
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NATION'S LARGEST FEDERAL SAVINGS ASSOCIATION

pays you 4½% on savings

DIVIDENDS PAID QUARTERLY at 4½% current annual rate • World-wide savings service for 180,000 individuals, corporations and trusts in 50 states, 76 foreign countries • Same, sound management policies since 1925. Assets over $690 million • Accounts insured by Federal Savings & Loan Insurance Corp. • A man and wife, with 2 individual accounts and 1 joint account, can have up to $30,000 in fully insured savings • Funds received by 10th, earn from 1st. • We pay air mail both ways • Mail check or money order with coupon below.

CALIFORNIA FEDERAL SAVINGS
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FREE FINANCIAL GUIDE: "The California Story" contains experts' ideas on saving money, investing in homes, insurance, stocks. Other exciting features!

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Box 54087, Terminal Annex, Los Angeles 54, Calif.
Please send free "The California Story" and Cal Fed MAIL-SAVER® to:

Name _____
Address _____
City _____ Zone _____ State _____
☐ Funds enclosed in amount of $ _____

TVA Guards Consumers

(*Continued from page* 109)

tives and the Bell Telephone System have been reviewed, and a new contract form has been worked out, said R. H. Franklin, McWhorter & Franklin, consulting engineers. The cooperatives own 85% of the jointly used poles and feel that higher rentals are in order. Other contract features will be taken up in the negotiations which will start soon.

Underground distribution was installed for a Cleveland, Tenn., shopping center because anticipated revenues justified the expenditures, said Allan Tankersley, also McWhorter & Franklin.

The owner of the shopping center signed a minimum revenue guarantee and furnished the underground primary ducts. The Cleveland Electric System installed primary cables and transformers. The shopping center owner installed and maintains the secondary system.

Reyrolle Technical Session Held in US for First Time

I-T-E Circuit Breaker Co has been associated with A. Reyrolle & Co, Ltd, for many years. Recently, the first biennial Reyrolle technical conference was held on American soil. Technical sessions at I-T-E's Philadelphia headquarters were supplemented by several visits to nearby utilities, industrial plants and commercial buildings. Among these was a tour of Delaware Power & Light Co's Delaware City station—the first plant of its kind to use fluid coke as fuel. The 14th Reyrolle conference was attended by managing directors and key engineering personnel from Merlin et Gerin, Grenoble, France; L. Knudsen, Copenhagen, Denmark; N. V. Hazemeyer, Hengelo, Holland; I-T-E and Reyrolle. Initially, I-T-E arranged to use the British firm's laboratories, (reportedly equipped to test at the highest voltages in the world) in order to augment its own research and test facilities. Later, I-T-E was invited to join the international conference group which meets formally every two years for the interchange of technical data related to development and manufacture of circuit breakers, switchgear and associated equipment.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: "OPPORTUNITIES" :EQUIPMENT :USED OR RESALE

DISPLAYED RATE: —RATES— UNDISPLAYED RATE:

EMPLOYMENT OPPORTUNITIES: $25.50 per inch. Subject to Agency Commission.

EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

OVERSEAS POSITIONS

ON SUBSTATION AND TRANSMISSION LINES IN THAILAND

Applications being accepted for the position of:

CHIEF SUPERVISOR

Graduate electrical engineer, or equivalent gained through experience, who has had a minimum of fifteen years' experience in the design and/or field construction of steel and wood substations of 220 KV and lower voltage transmission substations. Must be able to direct the placement of equipment, expedite delivery of materials and schedule progress of work. Familiarity with control and instrument circuits essential; must be competent to assume responsibility for energizing equipment and writing operating instructions. Supervisor must be able to instruct Thai supervisors, who speak and understand English, in all phases of the work and be an able and willing teacher in educating them for future similar responsibilities. Equipment will include structures, synchronous condenser, transformers, switchgear, controls, etc. Applicant must have had a successful record of accomplishment in his field. Applicants must be willing to sign a 24 month contract, pass a physical examination and security investigation. Salary, plus completion bonus, housing and food furnished. Air travel to and from Bangkok. Send complete experience record, include salary information to:

SVERDRUP & PARCEL AND ASSOCIATES, Inc.

915 Olive Street, St. Louis 1, Mo.

An equal opportunity employer

TRANSFORMERS

3—2500 KVA G-E 69000—2400/4160Y
3—2500 KVA G-E 69000—7200/12470Y
4—2500 KVA W-H 34500—2400/4160Y
3—1500 KVA G-E 69000—2400/4160Y
3—1500 KVA G-E 69000—7200/12470Y
3—1000 KVA G-E 34500-7200/12470Y
3—1000 KVA Wag. 34500—2400/4160Y
3— 833 KVA W-H 43800—480
3— 500 KVA A-Ch. 13800—240 x 480
3— 500 KVA A-Ch. 13200—240 x 480
3— 500 KVA A-Ch 7200/12470Y—240 x 480
3— 500 KVA A-Ch 2400/4160Y—240 x 480
3— 500 KVA A-Ch 13200—120/240
3— 333 KVA W-H 13200—2400/4160Y
3— 333 KVA Wag. 2400/4160Y—120/240
1—1500/1875 KVA Mol. 3-Ph. 34500—2400 F/C equipped

TRANSFORMERS WANTED

THE ELECTRIC SERVICE CO.

5316 Hetzel St.
Cincinnati 27, Ohio
49 Years' Dependable Service

APPLICATION ENGINEER

Position is in Marketing Department of prominent manufacturer of electric utility equipment. Should have at least two years experience in the application of relays, circuit breakers, reclosers and fuses. Ability to communicate effectively is essential. Limited national travel. Write to:

Personnel Manager
Line Material Industries
Kyle Products Plant
9th & Marion Avenues
South Milwaukee, Wis.

Usual employment opportunity for experienced

ELECTRICAL ENGINEERS WITH ELECTRIC UTILITY IN THE GROWING SOUTHWEST

Expanding electric utility needs Electrical Engineers with B.S. Degree. Minimum of 5 years utility experience of which 3 years shall have been in Distribution and/or Transmission Engineering. Growing community offers dry, sunny climate, mild winters, progressive schools, attractively priced housing. If you have considered moving your family to a healthier climate, send complete resume of experience, references and present salary.

P-7939, Electrical World
255 California St., San Francisco 11, Calif.

TENDERS

Tenders are invited for the supply of all or any of the following:—

1. **Transformer Operated Meters**
2. **High Voltage Oil Testing Set**
3. **Transformer Oil**
4. **33K. V. Substation Equipment**

Specifications may be obtained on writing to the Purchasing Officer, **Trinidad and Tobago Electricity Commission, P.O. Box 121, Port-of-Spain, Trinidad, W. I.**

Closing date for Tenders 22nd January, 1962.

ADDRESS BOX NO. REPLIES TO: Box No.
Classified Adv. Div. of this publication.
Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 645 N. Michigan Ave.
SAN FRANCISCO 11: 255 California St.

POSITIONS VACANT

Chief Electrical Engineer—Electrical engineering and design supervision of steam-electric power plants and substations for consulting firm in large eastern city. Background in planning, economic and system studies desirable. Ability to handle client relations is essential. Age 35-50. Send confidential resume. P-7845, Electrical World.

Electrical Engineer: Small New England utility requires an electrical engineer for distribution design, technical representative to local firms and related requirements. Position will be assistant to present department head. Replies will be handled in confidence. Write stating age, experience and salary expected to P-7834, Electrical World.

Electrical Engineer, Graduate E.E. to take charge of relay, meter substation maintenance and line department for progressive 150 MW system. Location south central U.S. Ideal opportunity for ambitious man. Send resume and salary expected. P-7925, Electrical World.

"Put Yourself in the Other Fellow's Place"

TO EMPLOYERS

TO EMPLOYEES

Letters written offering Employment or applying for same are written with the hope of satisfying a current need. An answer, regardless of whether it is favorable or not, is usually expected.

MR. EMPLOYER, won't you remove the mystery about the status of an employee's application by acknowledging all applicants and not just the promising candidates.

MR. EMPLOYEE you, too, can help by acknowledging applications and job offers. This would encourage more companies to answer position wanted ads in this section.

We make this suggestion in a spirit of helpful cooperation between employers and employees.

This section will be the more useful to all as a result of this consideration.

Classified Advertising Division

McGRAW-HILL PUBLISHING CO., INC.

330 West 42nd St., New York 36, N. Y.

OVERSEAS POSITIONS

ON SUBSTATION AND TRANSMISSION LINES IN THAILAND

Applications being accepted for the position of:

TRANSMISSION LINE AND SUBSTATION CONSTRUCTION SUPERVISOR

Construction engineer or general foreman with a minimum of ten years' experience in supervising the construction of 230 KV and 69 KV lines and substations. Technical graduate desirable, but equivalent in experience may be acceptable. Must have directly supervised the construction of steel and wood transmission lines and substations of voltages mentioned, including the procurement of materials, location and placement, of equipment etc. Ability to direct native Thai supervisors, who speak and understand English, and train them for responsible direction of future work necessary. Must be able to plan work from drawings and supervise forces to avoid delays and expedite completion. Good working knowledge of all standard line and substation materials and equipment of 69 KV and 230 KV essential. Supervisor must prepare intelligent and complete written reports of daily and weekly progress for management and the record. Applicants must be willing to sign a 24 month contract, pass a physical examination and security investigation. Salary, plus completion bonus, housing and food furnished. Air Travel to and from Bangkok. Send complete experience record, include salary information to:

SVERDRUP & PARCEL AND ASSOCIATES, Inc.
915 Olive Street St. Louis 1, Mo.
An equal opportunity employer

SWITCHGEAR MARKETING

Growth opportunity for graduate engineer with 4–7 years experience in metal-clad or related switchgear application and sales. Send complete resume including salary requirement to:

Moloney Electric Company
Switchgear Division
Attn: Sales Manager
4330 Geraldine Avenue
St. Louis 15, Missouri

SELL US YOUR NEW
USABLE ELECTRIC WIRE & CABLE
Send Us Your Listings
Our Offering Will Follow Immediately
PIERCE WIRE & CABLE CO.
2919 N. Paulina St. Chicago 13, Ill.
EAstgate 7-4777

TRW

COMPUTERS COMPANY

- POWER ENGINEERS
- ELECTRIC UTILITY ENGINEERS

To assist in the application of digital data processing and control computers to

STEAM POWER PLANTS

Expanding activities by TRW Computers Company in the electric utility industry have created important applications engineering positions with responsibilities for the application of TRW digital control computers to electric steam plants. Applications engineers participate in market planning, coordinate and participate in engineering discussions with customers to define control systems requirements, supervise the preparation of proposals, and assist in sales follow-up activities. Applicants should be graduate engineers with 3 to 10 years of power engineering experience in design, operation, or instrumentation and control of electric steam plants, including tests and evaluations to improve station performance. Knowledge, use, programming, or installation of computer or data processing systems in steam power plants is desirable, but not essential.

Send resume including salary history to Mr. R. J. Kremple

TRW

COMPUTERS COMPANY
A Division of
Thompson Ramo Wooldridge Inc.

8433 Fallbrook Avenue
Canoga Park, California

An equal opportunity employer.

Meetings Calendar

JANUARY—1962

Public Utilities Advertising Association—Region 9 Meeting, Palm Springs, Calif., Jan. 18-19.

American Society of Mechanical Engineers—Symposium on Thermophysical Properties, Princeton University, Princeton, New Jersey, Jan. 22-26.

• **Doble Client Conference**—29th Annual Conference, Sheraton-Plaza Hotel, Boston, Mass., Jan. 22-26.

Southeastern Electric Exchange—Legal and Claims Committee, Roosevelt Hotel, New Orleans, La., Jan. 24-25.

American Institute of Electrical Engineers—Winter General Meeting, Statler Hotel, New York City, Jan. 28-Feb. 2.

American Management Association—Session on Industrial Preparedness-Planning for Corporate Continuity and Survival, Astor Hotel, New York City, Jan. 31-Feb. 2.

FEBRUARY

National Association of Purchasing Agents—Public Utility Buyers' Group Meeting, San Francisco, Calif., Feb. 4-6.

• **National Industrial Electric Heating Conference**—The Netherland Hilton Hotel, Cincinnati, Ohio, Feb. 5-8.

American Public Power Association—Workshop, Peabody Hotel, Memphis, Tenn., Feb. 7-9.

• **EEI-AGE**—Accounting Conference Final Workshop Meeting, Sheraton Cleveland Hotel, Cleveland, Ohio, Feb. 8-9.

National Electrical Week—Feb. 11-17.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 15-16.

Pacific Coast Electrical Association—Business Development Section, Huntington-Sheraton Hotel, Pasadena, Calif., Feb. 26-27.

MARCH

• **National Association of Home Improvement Contractors**—20th Annual Home Improvement Trade Show, New York Coliseum, New York City, March 2-4.

• **Southern Safety Conference & Exposition**—Marion Hotel, Little Rock, Ark., March 4-6.

• **American Society of Mechanical Engineers**—Gas Turbine Power Conference & Exhibit, Shamrock-Hilton Hotel, Houston, Texas, March 4-8.

• **National Electrical Manufacturers Association**—2nd Electric Comfort Heating Symposium, Hotel Sherman, Chicago, March 19-21.

• **Oklahoma Utilities Association**—Annual Meeting, Oklahoma City, Okla., March 22-23.

• **Pacific Coast Electrical Association**—Engineering & Operating Section, Sheraton-Palace Hotel, San Francisco, Calif., March 22-23; Administrative Services Section, Villa Hotel, San Mateo, Calif., March 26-27.

• **Institute of Radio Engineers**—International Convention, Coliseum & Waldorf-Astoria Hotel, New York City, March 26-29.

• **Southeastern Electric Exchange**—29th Annual Conference, Boca Raton Hotel & Club, Boca Raton, Fla., March 26-28.

• **American Power Conference**—Illinois Institute of Technology, Sherman Hotel, Chicago, Ill., March 27-29.

• **Third Symposium on Engineering Aspects of Magnetohydrodynamics**—Sponsored by AIEE-IAS-IRE and the University of Rochester, University of Rochester, Rochester, N. Y., March 28-29.

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Exide determines the best battery type and charger for you by studying your particular duty requirements

Selecting a battery and charger today is really an engineering job. Each application has its own requirements. That's why Exide offers a variety of batteries and chargers—in fact the broadest in the field. It means you can buy the type battery and charger you should have. Because Exide has no ax to grind for any particular type, you can expect an unbiased recommendation.

The battery line includes (1) flat plate Tytex with Silvium;* (2) flat plate Tytex with calcium; (3) long-life Exide-Manchex—Planté type—with Silvium; (4) low-maintenance pocket positive nickel-cadmium; (5) new 20-year Exide-Ironclad tubular with Silvium. The charger line includes (1) constant voltage type; (2) trickle or Hi-Lo type. You get Exide quality and value on all.

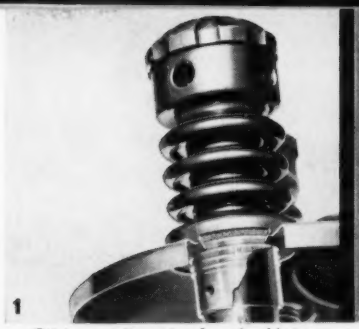
An Exide power package lets you buy with confidence. Exide service—the quickest, most dependable you can get—covers battery and charger. For complete information, write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

*Silvium is Exide's patented corrosion-resistant grid alloy

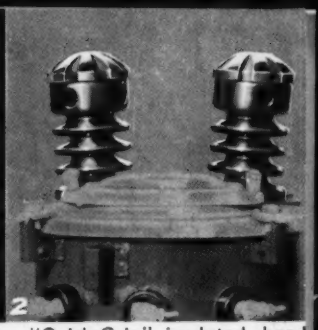
Exide®

INDUSTRIAL MARKETING DIVISION (ESB)
The Electric Storage Battery Company

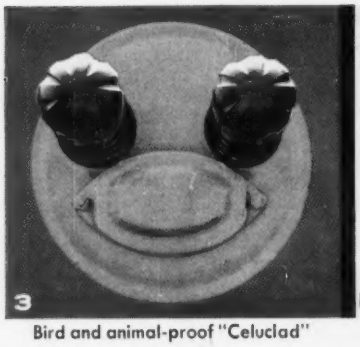
12 Reasons Why You Get extra value in Kuhlman Transformers



1 Oil-less radio noise free bushings with internal clamping sleeve.

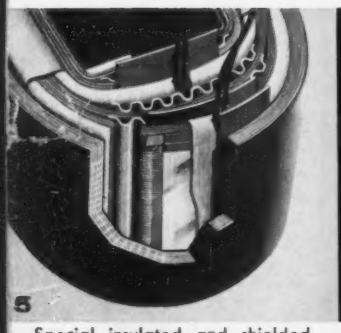


2 "Quick-Grip" insulated hand connectors.



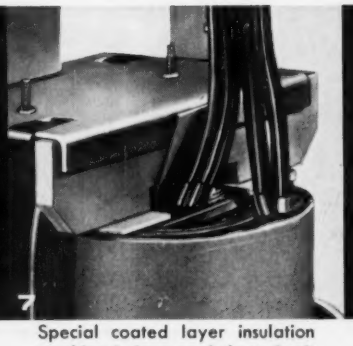
3 Bird and animal-proof "Celuclad" covers.

4 Spring-pressure low voltage connectors for copper and aluminum conductors.

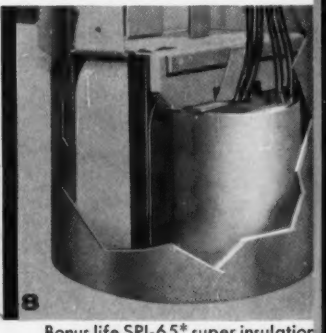


5 Special insulated and shielded primary windings with greater ability to withstand lightning and switching surges.

6 Brighter, longer lasting "Lucite" finish.



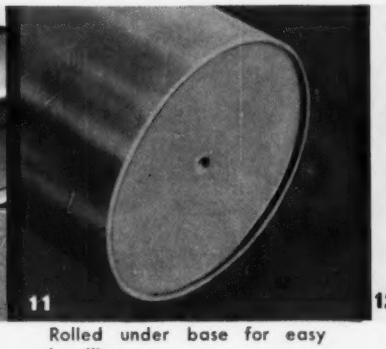
7 Special coated layer insulation resulting in improved short-circuit capability.



8 Bonus life SPI-65* super insulation

9 Gleaming white interiors that let you see right to the bottom of the tank.

10 Low-loss Kuhlman core with better performance guarantees.



11 Rolled under base for easy handling.

12 Lighter, smaller designs that are more economical to operate and maintain.

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Manufacturers of transformers since 1894

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